

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-027899

(43)Date of publication of application : 04.02.1994

(51)Int.Cl. G09G 3/36

(21)Application number : 04-307323

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(22)Date of filing : 17.11.1992

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(30)Priority

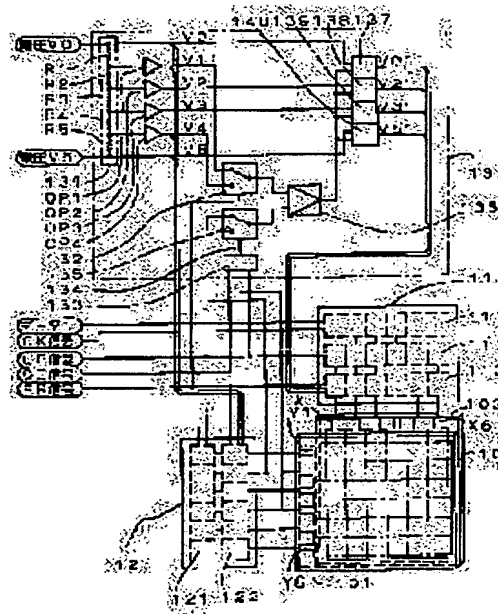
Priority number : 04122144
04122145Priority date : 14.05.1992
14.05.1992Priority country : JP
JP

(54) LIQUID CRYSTAL DISPLAY DEVICE AND ELECTRONIC EQUIPMENT

(57)Abstract:

PURPOSE: To reduce the generation of display unevenness with simple circuit constitution by detecting the voltage variation or current variation at a certain part of a liquid crystal display device system and assuming distortion generated on an electrode of a liquid crystal panel, and adding a correcting voltage, generated on the basis of the distortion, to a driving voltage waveform.

CONSTITUTION: An input voltage switching control circuit 133 outputs the voltage that a Y driver 12 outputs to a scanning electrode Y5 in a period wherein a selection voltage is applied from a scanning electrode Y1 to Y3, the voltage that the Y driver 12 to a scanning electrode Y2 in a period wherein the selection voltage is applied from Y4 to Y6 to a differential amplifier circuit 136 respectively. Then the differential amplifier circuit 136 outputs only the distortion of the voltage waveform that the Y driver 12 outputs to the scanning electrode Y2 or Y5. This distortion is added by voltage adding circuits 137-140 to voltages V0-V4 to obtain voltages V0'-V4', which are outputted to an X driver 11. Namely, voltage variations on the scanning electrodes Y1-Y6 are detected and the voltages on signal electrodes X1-X6 are also varied corresponding to them.



LEGAL STATUS

[Date of request for examination] 16.09.1999

[Date of sending the examiner's decision of rejection] 05.03.2002

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

BEST AVAILABLE COPY

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection] 2002-05832

[Date of requesting appeal against examiner's decision of rejection] 04.04.2002

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The liquid crystal panel with which it is formed so that two or more scan electrodes may be formed in one substrate of the substrate of the pair which pinches a liquid crystal layer and two or more signal electrodes may intersect said scan electrode at the substrate of another side, and the amount of this intersection becomes a display dot, The scan electrode drive circuit which supplies a driver voltage wave to said two or more scan electrodes of each of this liquid crystal panel, The signal-electrode drive circuit which supplies a driver voltage wave to said two or more signal electrodes of each, The power circuit which generates two or more electrical potential differences which need two or more electrical potential differences and said signal-electrode drive circuits which need said scan electrode drive circuit to form the driver voltage wave supplied to said two or more scan electrodes of each to form the driver voltage wave supplied to said two or more signal electrodes of each, In the liquid crystal display possessing the amendment means which adds the correction voltage according to the alphabetic character and graphic form which said liquid crystal panel displays to at least said driver voltage [to which it is impressed by said scan electrode] wave-like, and said driver voltage wave-like one side which are impressed to said signal electrode The electrical potential difference which said amendment means generates in a part of said liquid crystal panel, said scan electrode drive circuit, said signal-electrode drive circuit, or power circuit [at least], Or the liquid crystal display characterized by making into said correction voltage said electrical potential difference which possesses a detection means to detect change of a current and this detection means detects, or the electrical potential difference of the magnitude according to change of a current.

[Claim 2] The liquid crystal display characterized by detecting electrical-potential-difference change of a difference with at least one electrical potential difference in a liquid crystal display according to claim 1 among the electrical potential differences which said detection means needs for forming the driver voltage wave of at least 1 scan electrode, and the driver voltage wave which said scan electrode drive circuit which said power circuit generates supplies to said two or more scan electrodes of each among said two or more scan electrodes of each of said liquid crystal panel.

[Claim 3] It forms so that the substrate with which said scan electrode of said liquid crystal panel is formed may be intersected in a liquid crystal display according to claim 1 with said some of two or more signal electrodes [at least] in at least one or more electrical-potential-difference detection electrodes. Or the liquid crystal display with which it forms so that the substrate with which said signal electrode of said liquid crystal panel is formed may be intersected with said some of two or more scan electrodes [at least] in at least one or more electrical-potential-difference detection electrodes, and said detection means is characterized by detecting the voltage variation generated in said electrical-potential-difference detection electrode.

[Claim 4] The liquid crystal display characterized by detecting the current to which said detection means flows in said scan electrode drive circuit from said power circuit in a liquid crystal display according to claim 1 about at least one electrical potential difference which said power circuit supplies to said scan electrode drive circuit.

[Claim 5] The liquid crystal display characterized by setting up the predetermined function with which said amendment means makes change of the said two or more electrical potential differences or the current which said detection means detects two or more variables, and generating the correction voltage according to this function when change of the electrical potential difference or current which said detection means detects is plurality in a liquid crystal display claim 2, 3, or given in four.

[Claim 6] The liquid crystal display characterized by being the function with which said function equalizes said two or more variables in a liquid crystal display according to claim 5.

[Claim 7] When said electrical-potential-difference detection electrode formed in said liquid crystal panel is plurality in a liquid crystal display according to claim 3 Two or more correction voltage which set up the predetermined function with which said amendment means makes change of the electrical potential difference which said detection means detects from said each electrical-potential-difference detection electrode two or more variables, and responded to this function is generated, The liquid crystal display characterized by making into either of said two or more correction voltage correction voltage added to said drive wave of said signal electrode or said scan electrode according to the location within said liquid crystal panel of said signal electrode or said scan electrode in which it is located.

[Claim 8] The liquid crystal display with which said electrical-potential-difference detection electrode is characterized by having changed the area of the part which this electrical-potential-difference detection electrode, said two or more signal electrodes, or said scan electrode intersects respectively with said signal electrode or said scan electrode in a liquid crystal display according to claim 3.

[Claim 9] Two or more correction voltage which set up two or more predetermined functions with which said amendment means makes change of the said two or more electrical potential differences or the current which said detection means detects two or more variables in a liquid crystal display according to claim 5, and responded to these two or more functions is generated, The liquid crystal display characterized by making into either of said two or more correction voltage correction voltage added to said drive wave of said signal electrode or said scan electrode according to the location within said liquid crystal panel of said signal electrode or said scan electrode in which it is located.

[Claim 10] The liquid crystal display characterized by generating the correction voltage according to the number of dots to which said amendment means is [of said display dots of electrical-potential-difference change which said detection means detects, and said liquid crystal panel] on in a liquid crystal display according to claim 3.

[Claim 11] Electronic equipment characterized by providing a liquid crystal display claim 1, 2, 3, 4, 5, 6, 7, 8, 9, or given in ten.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to an improvement of display unevenness in detail about a liquid crystal display.

[0002]

[Description of the Prior Art] A drive and a display are performed because the liquid crystal panel of a liquid crystal display supplies the voltage waveform (it is henceforth called a driver voltage wave.) which consisted of different electrical potential differences generated in the scan electrode and signal electrode which constitute a liquid crystal panel in the power circuit in a liquid crystal display. And these driver voltage waves change according to the contents which a liquid crystal panel displays.

[0003] Here, distortion arose in the voltage waveform impressed to a scan electrode and a signal electrode by the voltage waveform which a liquid crystal panel is a capacitive load, and is impressed to a scan electrode and a signal electrode since the scan electrode and the signal electrode have electric resistance, and there was a problem said that unevenness occurs in a display by this.

[0004] The approach of adding correction voltage to a driver voltage wave which was shown by JP,2-89,A for which the writer etc. applied, and correcting distortion about this problem, was learned.

[0005]

[Problem(s) to be Solved by the Invention] However, since the approach shown by JP,2-89,A etc. needed the circuit for calculating the amount of amendments beforehand when performing this although it could reduce display unevenness remarkably, the liquid crystal display became complicated and small lightweight-ization was difficult.

[0006] This invention is made in view of this problem, and it notes that distortion produced in the voltage waveform impressed to a scan electrode and a signal electrode is specified by total of change of the electrical potential difference on the signal electrode to the electrical potential difference on a scan electrode. Since the current according to total of change of this electrical potential difference furthermore flows to a power circuit, distortion generated in the scan electrode or signal electrode within a liquid crystal panel by supervising change of these electrical potential differences or change of a current is presumed. It is what is going to cancel display unevenness by adding the correction voltage which offsets this distortion to a driver voltage wave. The purpose is in offering the electronic equipment which canceled display unevenness by simple circuitry and carried the high display and the legible display of display grace and which was formed into small lightweight.

[0007]

[Means for Solving the Problem] The liquid crystal panel with which the liquid crystal display of the 1st this invention is formed so that two or more scan electrodes may be formed in one substrate of the substrate of the pair which pinches a liquid crystal layer and two or more signal electrodes may intersect said scan electrode at the substrate of another side, and the amount of this intersection becomes a display dot, The scan electrode drive circuit which supplies a driver voltage wave to said two or more scan electrodes of each of this liquid crystal panel, The signal-electrode drive circuit which supplies a driver

voltage wave to said two or more signal electrodes of each, The power circuit which generates two or more electrical potential differences which need two or more electrical potential differences and said signal-electrode drive circuits which need said scan electrode drive circuit to form the driver voltage wave supplied to said two or more scan electrodes of each to form the driver voltage wave supplied to said two or more signal electrodes of each, In the liquid crystal display possessing the amendment means which adds the correction voltage according to the alphabetic character and graphic form which said liquid crystal panel displays to at least said driver voltage [to which it is impressed by said scan electrode] wave-like, and said driver voltage wave-like one side which are impressed to said signal electrode The electrical potential difference which said amendment means generates in a part of said liquid crystal panel, said scan electrode drive circuit, said signal-electrode drive circuit, or power circuit [at least], Or a detection means to detect change of a current is provided and the description of making into said correction voltage said electrical potential difference which this detection means detects, or the electrical potential difference of the magnitude according to change of a current is carried out.

[0008] The liquid crystal display of the 2nd this invention is set to the liquid crystal display of the 1st this invention. Although said detection means forms the driver voltage wave of at least 1 scan electrode, and the driver voltage wave which said scan electrode drive circuit which said power circuit generates supplies to said two or more scan electrodes of each among said two or more scan electrodes of each of said liquid crystal panel It is characterized by detecting electrical-potential-difference change of a difference with at least one electrical potential difference among required electrical potential differences.

[0009] The liquid crystal display of the 3rd this invention is set to the liquid crystal display of the 1st this invention. It forms so that the substrate with which said scan electrode of said liquid crystal panel is formed may be intersected with said some of two or more signal electrodes [at least] in at least one or more electrical-potential-difference detection electrodes. Or it forms so that the substrate with which said signal electrode of said liquid crystal panel is formed may be intersected with said some of two or more scan electrodes [at least] in at least one or more electrical-potential-difference detection electrodes, and said detection means is characterized by detecting the voltage variation generated in said electrical-potential-difference detection electrode.

[0010] The liquid crystal display of the 4th this invention is characterized by detecting the current to which said detection means flows in said scan electrode drive circuit from said power circuit about at least one electrical potential difference which said power circuit supplies to said scan electrode drive circuit in the liquid crystal display of the 1st this invention.

[0011] It is characterized by for the liquid crystal display of the 5th this invention setting up the predetermined function with which said amendment means makes change of the said two or more electrical potential differences or the current which said detection means detects two or more variables when change of the electrical potential difference or current which said detection means detects is plurality in the liquid crystal display of this invention of the 2nd, 3, or 4, and generating the correction voltage according to this function.

[0012] The liquid crystal display of the 6th this invention is characterized by being the function with which said function equalizes said two or more variables in the liquid crystal display of the 5th this invention.

[0013] The liquid crystal display of the 7th this invention is set to the liquid crystal display of the 3rd this invention. When said electrical-potential-difference detection electrode formed in said liquid crystal panel is plurality, generate two or more correction voltage which set up the predetermined function with which said amendment means makes change of the electrical potential difference which said detection means detects from said each electrical-potential-difference detection electrode two or more variables, and responded to this function, It is characterized by making into either of said two or more correction voltage correction voltage added to said drive wave of said signal electrode or said scan electrode according to the location within said liquid crystal panel of said signal electrode or said scan electrode in which it is located.

[0014] The liquid crystal display of the 8th this invention is characterized by said electrical-potential-

difference detection electrode having changed the area of the part which this electrical-potential-difference detection electrode, said two or more signal electrodes, or said scan electrode intersects respectively with said signal electrode or said scan electrode in the liquid crystal display of the 3rd this invention.

[0015] The liquid crystal display of the 9th this invention is set to the liquid crystal display of the 5th this invention. Two or more correction voltage which set up two or more predetermined functions with which said amendment means makes change of the said two or more electrical potential differences or the current which said detection means detects two or more variables, and responded to these two or more functions is generated, It is characterized by making into either of said two or more correction voltage correction voltage added to said drive wave of said signal electrode or said scan electrode according to the location within said liquid crystal panel of said signal electrode or said scan electrode in which it is located.

[0016] The liquid crystal display of the 10th this invention is characterized by said amendment means generating the correction voltage according to the number of dots to which said detection means is [of said display dots of electrical-potential-difference change to detect and said liquid crystal panel] on in the liquid crystal display of the 3rd this invention.

[0017] The electronic equipment of the 11th this invention is characterized by providing the liquid crystal display of this invention of the 1st, 2, 3, 4, 5, 6, 7, 8, 9, or 10.

[0018]

[Example]

The drive approach of [example 1] this invention is explained in more detail using an example. Here, the case where the display unevenness first generated in the array direction of the signal electrode of a liquid crystal panel is canceled is explained.

[0019] Drawing 1 is drawing showing the configuration of this example. By a diagram, while consists of substrates 101 and 102 of the pair to which 10 pinches a liquid crystal layer (not shown) with a liquid crystal panel, and signal electrodes X1-X6 are formed in the scan electrodes Y1-Y6 and the substrate 102 of another side at the substrate 101. Here, respectively, the scan electrodes Y1-Y6 and signal electrodes X1-X6 are for this simplifying explanation with six, although it is few, and there are usually farther than this. [many]

[0020] 11 is X driver and 111-113 are a 6 bits shift register circuit, a 6-bit latch circuit, and the analog switching circuit of 4 circuit 1 6-bit contact with the internal configuration element, respectively. In addition, the number of bits is the number of the signal electrodes of a liquid crystal panel 10.

[0021] 12 is Y driver and 121 and 122 are a 6-bit shift register circuit and the analog switching circuit of 4 circuit 1 6-bit contact with the internal configuration element, respectively. In addition, the number of bits is the number of the scan electrodes of a liquid crystal panel 10. And a data signal, CK signal, LP signal, DI signal, and FR signal are incorporated from the exterior. The above configuration is the same as the configuration of the conventional technique.

[0022] 13 is a power circuit and it is the electrical-potential-difference V0-electrical-potential-difference V1= electrical-potential-difference V1-electrical-potential-difference V2= electrical-potential-difference V3-electrical-potential-difference V4= electrical-potential-difference V4-electrical potential difference V5 (= it sets with V.) about the electrical potential difference of 6 level required to drive a liquid crystal panel. electrical-potential-difference V0-electrical-potential-difference V5=n-V (n -- a positive number - - it is -- usually -- 10 order --) the case where the electrical potential differences V0-V5 which have unrelated relation are generated -- 131 -- an electrical-potential-difference dividing network -- it is -- from five resistors R1, R2, R3, R4, and R5 -- becoming -- resistors R1, R2, R4, and R5 -- R -- resistance -- having -- R3 -- R (n-4) -- it has resistance. If an electrical potential difference V0 and an electrical potential difference V5 are impressed to the both ends of this electrical-potential-difference dividing network 131, i.e., drawing, to the bottom of a resistor R5 a resistor R1 top, respectively, electrical potential differences V1, V2, V3, and V4 will be divided, respectively between each resistor R1, R2 and R2, and R3, R3, R4 and R5 [4 and], and it will generate.

[0023] OP1-OP4 are voltage follower circuits which lower an impedance and output the electrical

potential differences V1, V2, V3, and V4 which the electrical-potential-difference dividing network 11 generated. Generally these voltage follower circuits OP1-OP4 are constituted by the operation amplifying circuit.

[0024] 132 is a reference voltage changeover switch and is a switch which changes and outputs an electrical potential difference V1 or an electrical potential difference V4 according to FR signal.

[0025] 133 is an input voltage change control circuit, and while Y driver is outputting the selection electrical potential difference to either of Y3 from the scan electrode Y1, it is a circuit which outputs the switch control signal 134 set to "1" in "0" while outputting the selection electrical potential difference to either of Y6 from the scan electrode Y4. Since it can form easily in the comparator circuit which compares the size as a result of the counting circuit where this circuit made LP signal the clock signal, and made DI signal the reset signal, and this counting circuit, especially the thing illustrated and explained is omitted.

[0026] 135 is an input voltage changeover switch, and when the switch control signal 134 is "1", it chooses and outputs the voltage waveform which outputs the electrical potential difference which the Y driver 12 outputs to the scan electrode Y2 to Y5 at the time of "0."

[0027] 136 is a differential amplifying circuit and outputs the difference of the electrical potential difference outputted from the reference voltage changeover switch 21 and the input voltage changeover switch.

[0028] 137 - 140 -- an electrical potential difference -- an adder circuit -- it is -- each -- the exterior -- from -- supplying -- having -- an electrical potential difference -- and -- voltage - a follower -- a circuit -- OP -- two -- OP -- three -- outputting -- an electrical potential difference -- V -- zero -- V -- two -- V -- three -- V -- five -- a differential amplifying circuit -- 136 -- outputting -- an electrical potential difference -- having added -- an electrical potential difference -- respectively -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- ***** -- outputting . The concrete example of 1 configuration of the electrical-potential-difference adder circuits 137-140 is shown in drawing 2 here. Either of the electrical potential differences V0, V2, V3, and V5 of drawing 1 inputs Terminal Vref by a diagram with the terminal which inputs reference voltage. Terminal Vin inputs the electrical potential difference which a differential amplifying circuit 136 outputs by drawing 2 . 201 forms a resistor by the capacitor, 202 forms a differential circuit, and 203 is a voltage follower circuit by the operation amplifying circuit. a terminal -- Vout -- voltage - a follower -- a circuit -- 203 -- an output -- drawing 1 -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- corresponding . Here, since the electrical potential difference which the differential amplifying circuit 136 inputted into Terminal Vin by drawing 2 outputs is almost close to a differential wave, it can output the electrical potential difference which applied the electrical potential difference of Terminal Vin to the electrical potential difference of Terminal Vref in approximation from the voltage follower circuit 203 by connecting this electrical potential difference to the terminal Vin of the differential circuit which consists of resistance 201 and a capacitor 202.

[0029] and -- drawing 1 -- an electrical potential difference -- V -- zero -- V -- one -- V -- four -- V -- five -- Y -- a driver -- 12 -- supplying -- having -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- X -- a driver -- 11 -- supplying -- having . here -- Y -- a driver - 12 -- supplying -- an electrical potential difference -- V -- five -- V -- one -- and -- X -- a driver -- 11 -- supplying -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- respectively -- the -- one -- an electrical potential difference -- a group -- selection -- an electrical potential difference -- un--- selection -- an electrical potential difference -- lighting -- an electrical potential difference -- astigmatism -- a LGT -- an electrical potential difference -- a call -- an electrical potential difference -- V -- zero -- V -- four -- V -- five -- ' -- V -- three -- ' -- respectively -- the selection electrical potential difference of the 2nd electrical-potential-difference group, a non-choosing electrical potential difference, a lighting electrical potential difference, and an astigmatism LGT electrical potential difference -- calling .

[0030] It has the above composition. In addition, about connection between each circuit, with drawing, since it is clear, explanation is omitted. And as shown in drawing 3 , a data signal, CK signal, LP signal, and DI signal are supplied from the outside.

[0031] Here, actuation is explained.

[0032] First, the X driver 11 incorporates the data signal which determines the contents of a display synchronizing with CK signal shown in drawing 3 one by one to a shift register circuit 111, and shifts it to it. And if only the number of signal electrodes of a liquid crystal panel 10 and the same number incorporate data to a shift register circuit 111, synchronizing with LP signal shown in drawing 3, the contents of each bit of a shift register circuit 111 will be incorporated by each bit of a latch circuit 112. The level-shifter circuit 113 outputs the electrical potential difference according to the contents and the FR signal 15 which were incorporated to the latch circuit 112. That is, when the contents of each bit incorporated to the latch circuit 112 show lighting (henceforth referred to as "1"), a lighting electrical potential difference is outputted, and when the contents show an astigmatism LGT (henceforth referred to as "0"), an astigmatism LGT electrical potential difference is outputted. And the 1st electrical-potential-difference group is outputted about the case where it is shown that FR signal chooses the 1st electrical-potential-difference group (henceforth referred to as "0"), and the 2nd electrical-potential-difference group is outputted about the case where it is shown that FR signal chooses the 2nd electrical-potential-difference group (henceforth referred to as "1").

[0033] The Y driver 12 incorporates DI signal shown in drawing 4 which determines the scan electrode chosen synchronizing with LP signal one by one to a shift register circuit 121, and shifts it to it. The level-shifter circuit 122 outputs the electrical potential difference according to the contents and the FRI signal 15 which were incorporated to the latch circuit 121. That is, when the contents of each bit incorporated to the latch circuit 112 show selection, a selection electrical potential difference is outputted, and when the contents show un-choosing, a non-choosing electrical potential difference is outputted. And the 1st electrical-potential-difference group is outputted about the case where the FR signal 15 is "0", and the 2nd electrical-potential-difference group is outputted about the case where FR signal is "1."

[0034] The electrical potential difference which the Y driver 12 outputs to the scan electrode Y2 in the period which outputs the electrical potential difference which the Y driver 12 outputs to the scan electrode Y5 in the period when, as for the input voltage change control circuit 133, a selection electrical potential difference impresses an input voltage changeover switch to Y3 from the scan electrode Y1 here to a differential amplifying circuit 136, and a selection electrical potential difference impresses to Y6 from the scan electrode Y4 is outputted to a differential amplifying circuit 136. Therefore, the electrical potential difference superimposed on distortion by the voltage waveform from which electrical potential differences V1 and V4 always change according to FR signal is outputted to 136.

[0035] In 132, at this time, a reference voltage changeover switch outputs either of the electrical potential differences V1 and V4 to a differential amplifying circuit 136 according to FR signal.

[0036] Therefore, only a part for distortion of the voltage waveform by which the Y driver 12 outputs a differential amplifying circuit 136 to the scan electrode Y2 or Y5 is outputted.

[0037] this -- distortion -- a part -- an electrical potential difference -- an adder circuit -- 137 - 140 -- an electrical potential difference -- V -- zero -- V -- two -- V -- three -- V -- four -- adding -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- four -- ' -- ***** -- the X driver 11 -- outputting .

[0038] The above actuation is performed.

[0039] Therefore, if distortion (this is set to V_e .) occurs on the electrical potential difference on the scan electrode which a non-choosing electrical potential difference (V_1 or V_4) impresses, the electrical potential difference on a scan electrode will serve as $V_c + V_e$. this -- the time -- a signal electrode -- a top -- an electrical potential difference -- an electrical potential difference -- V -- zero -- V -- one -- or -- V -- three -- V -- five -- V_e -- having added -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- or -- V -- three -- ' -- V -- five -- ' -- becoming . Therefore, the electrical-potential-difference difference of a scan electrode and a signal electrode is V_0' . - $V_1 = (V_0 + V_e)$ It is set to $-(V_1 + V_e) = VV_1 - V_2' = (V_1 + V_e) - (V_2 + V_e) = VV_3' - V_4 = (V_3 + V_e) - (V_4 + V_e) = VV_4 - V_5' = (V_4 + V_e) - (V_5 + V_e) = V$, and a difference always becomes fixed regardless of the distorted magnitude sense. Therefore, a difference is lost to the effective voltage impressed to each dot of a liquid crystal panel 10, and display unevenness is

lost. This is shown in drawing 4. the electrical potential difference V_0 when drawing 4 performs the display with a liquid crystal panel 10 - an electrical potential difference V_2 , and an electrical potential difference V_0 -- it is drawing showing a part of output wave of the Y driver 12 outputted to '- V_2 ' and the scan electrode Y2 thru/or Y5.

[0040] 401-402 of a broken line show electrical potential differences V_0 - V_2 by a diagram, and 404 of a continuous line and 406 show electrical-potential-difference V_0' and the output wave of the Y driver 12 which shows V_2' and outputs 405 of a continuous line to the scan electrode Y2 thru/or Y5. 407 and 408 -- respectively -- the output wave of electrical-potential-difference V_0' , and the V_2' and the Y driver 12 - the electrical-potential-difference difference of 405 is shown. [and] In addition, a few is shifted and it is displayed that 401-403 are legible. here -- the output wave of the Y driver 12 -- if 405 is distorted and voltage variation occurs, this will be followed and 404 and 406, electrical-potential-difference V_0 [i.e.,],' and V_1' will also change an electrical potential difference. By this, the electrical-potential-difference differences 407 and 408 become always fixed, without depending distorted. Here, although the 1st electrical-potential-difference group was explained, it becomes the same also about the 2nd electrical-potential-difference group.

[0041] Although a part for distortion of the voltage waveform which the Y driver 12 outputs was only added to the electrical potential difference supplied to the X driver 11, since the interior of a liquid crystal panel 10 is more greatly distorted from distortion of the voltage waveform which the Y driver 12 outputs, the electrical potential difference added to the electrical potential difference supplied to the X driver 11 in consideration of at this rate may be enlarged slightly. This can be easily set up by setting the gain of a differential amplifying circuit 136 as a suitable value. And it is not necessary to necessarily enlarge to distortion detected in this case at linearity.

[0042] In addition, although the scan electrode to refer to was set to Y2 and Y5 here, there is nothing that is limited to this, of course, and it is good even about the scan electrode of which location. Moreover, the distortion about two or more scan electrodes may be equalized and used.

[0043] By detecting the voltage variation on a scan electrode and fluctuating the electrical potential difference on a signal electrode corresponding to this, as stated above, display unevenness was simply [easily and] cancelable.

[0044] Although the [example 2] example 1 showed how to add correction voltage to the driver voltage wave of a signal electrode, the effectiveness that it is also easy to add correction voltage to the driver voltage wave of a scan electrode and same can be acquired. This example is explained. Drawing 5 is drawing showing an example of the configuration of this example.

[0045] By a diagram, except 531 - 533 in a power circuit 53, it is the same as drawing 1, and since 53 carries out the same actuation, it attaches a jack per line and omits explanation in a power circuit.

[0046] 531 is a differential amplifying circuit, reverses a polarity and outputs the difference of the electrical potential difference outputted from the reference voltage changeover switch 21 and the input voltage changeover switch.

[0047] 532 and 533 are electrical-potential-difference adder circuits with the same circuitry as the electrical-potential-difference adder circuits 137-140 of drawing 1, and output the electrical potential difference adding the electrical potential difference which a differential amplifying circuit 531 outputs to the electrical potential differences V_1 and V_4 which the voltage follower circuits OP1 and OP4 output as electrical-potential-difference V_1' and V_2' , respectively.

[0048] And an electrical potential difference V_0 , V_1' , V_4' , and V_5 are supplied to the Y driver 12 by drawing 1, and electrical potential differences V_0 , V_2 , V_3 , and V_5 are supplied to the X driver 11. Here, the electrical potential differences V_0 and V_2 supplied to the electrical potential difference V_5 , V_1' , and the X driver 11 which are supplied to the Y driver 12 turn into the selection electrical potential difference of the 1st electrical-potential-difference group, a non-choosing electrical potential difference, a lighting electrical potential difference, and an astigmatism LGT electrical potential difference, respectively, and an electrical potential difference V_0 , V_4' , and V_5 and V_3 become the selection electrical potential difference of the 2nd electrical-potential-difference group, a non-choosing electrical potential difference, a lighting electrical potential difference, and an astigmatism LGT electrical

potential difference, respectively.

[0049] When the electrical potential difference on a scan electrode tends to serve as $V_c + V_e$ since it has the above composition if distortion (this is set to V_e) tends to occur on the electrical potential difference on the scan electrode which a non-choosing electrical potential difference (V_1 or V_4) impresses namely, distortion in which they tend to generate the electrical potential difference of $-V_e$ since the electrical-potential-difference adders 532 and 533 are added to electrical potential differences V_1 or V_4 is offset mostly. Therefore, on the non-choosing electrical potential difference on a scan electrode, distortion is almost lost, and display unevenness is lost.

[0050] Since the interior of a liquid crystal panel 10 is more greatly distorted from distortion of the voltage waveform which the Y driver 12 outputs, correction voltage added to the electrical potential difference supplied to the Y driver 12 in consideration of at this rate may be enlarged slightly. This can be easily set up by setting the gain of a differential amplifying circuit 531 as a suitable value. And it is not necessary to necessarily enlarge to distortion detected in this case at linearity.

[0051] Detecting the voltage variation on a scan electrode, as stated above, and fluctuating the electrical potential difference on a scan electrode corresponding to this was also able to cancel display unevenness.

[0052] Moreover, even if it applies correction voltage to both a signal electrode and the scan electrode of a driver voltage wave combining an example 1 and an example 2, there is same effectiveness.

[0053] An example besides [an example 3] is shown. In the examples 1 and 2, display unevenness was canceled by changing the electrical potential difference supplied to X driver or Y driver by distortion of the output wave of Y driver outputted to a specific scan electrode. Here, although JP,2-89,A for which the writer applied has explained in detail, if it says simply, distortion of the output wave of Y driver thru/or the voltage waveform on a scan electrode is prescribed by the total of change of an electrical potential difference to the scan electrode of each signal electrode. Therefore, an electrical-potential-difference detection electrode may be formed on the substrate with which the scan electrode of a liquid crystal panel is formed, capacity coupling of this electrical-potential-difference detection electrode may be carried out by the signal electrode and the liquid crystal layer, total of electrical-potential-difference change of a signal electrode may be detected, and the electrical potential difference which presumes the distortion on a scan electrode and is supplied to X driver from this result may be changed.

[0054] This is explained in more detail using drawing 6. Drawing 6 shows the configuration of this example. Except liquid crystal panel 10a and power circuit 63, it is the same as the configuration of drawing 1, and explanation is omitted by a diagram.

[0055] Liquid crystal panel 10a newly adds the electrical-potential-difference detection electrode YD on the substrate 101 of the liquid crystal panel 10 of drawing 1 by drawing 6. The electrical-potential-difference detection electrode YD is provided so that all the signal electrodes X_1 - X_6 may be countered, as shown in drawing. When the effects which make it generate from a signal electrode X_1 here on the scan electrode by the electrical-potential-difference change on X_6 differ for every signal electrode, the width of face of the electrical-potential-difference detection electrode YD may be formed so that it may become large, as it hopes that it is not uniform, for example, becomes the right from the left.

[0056] 63 is a power circuit in drawing 6, and since components other than 631 - 633 are the same as the power circuit 13 of drawing 1, explanation is omitted. 631 forms a differential circuit by the capacitor which consists of an electrical-potential-difference detection electrode YD prepared on liquid crystal panel 10a by the resistor, and signal electrodes X_1 - X_6 which counter this. 632 lowers an impedance and outputs the electrical potential difference generated in the electrical-potential-difference detection electrode YD in a voltage follower circuit. This voltage follower circuit 632 may not exist and may not necessarily be a twice [arbitration] as many noninverting amplifier as this in one 1 time the amplification factor of this. 633 is a switch which changes the electrical potential difference (it is henceforth called reference voltage) applied to the end of a resistor 631 in a switching circuit to an electrical potential difference V_1 or an electrical potential difference V_4 . That is, when Y driver uses the electrical potential difference V_1 as a non-choosing electrical potential difference and the electrical potential difference V_4 is used for the electrical potential difference V_1 , an electrical potential

difference V4 is applied to the end of a resistor 631. more than -- a configuration -- becoming -- **** -- since -- voltage - a follower -- a circuit -- 632 -- each -- a signal electrode -- X -- one - six -- an electrical potential difference -- change -- total -- having responded -- voltage variation -- generating -- since -- this -- voltage variation -- using -- an electrical potential difference -- an adder circuit -- 137 - 140 -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- generating .

[0057] The above configuration and actuation are carried out.

[0058] Therefore, since the same actuation as an example 1 is carried out, while acquiring the same effectiveness When the drive approach is not the electrical-potential-difference equalizing method (for example, when a liquid crystal panel is driven by the approach which the voltage waveform of a configuration which is different on the binary electrical potential difference shown by JP,60-247224,A etc. makes impress to a scan electrode, and drives) Since the configuration where the voltage waveforms of each scan electrode differed separately is carried out and it is difficult to carry out direct detection of the distortion of a scan electrode scan electrode, the approach of this example of presuming the distortion on a scan electrode with an electrical-potential-difference detection electrode is effective.

[0059] In addition, the switching circuit 631 is needed when the non-choosing electrical potential difference which the Y driver 12 uses uses two electrical potential differences of electrical potential differences V1 and V4. That is, it is because it is necessary to also change the reference voltage applied to the end of a resistor 631 when the non-choosing electrical potential difference which the Y driver 12 outputs changes from an electrical potential difference V1 (4) to V4 (1), in case total of the electrical-potential-difference change on the signal electrode to the non-choosing electrical potential difference which the Y driver 12 outputs is detected (when FR signal changes). Therefore, communalize a non-choosing electrical potential difference and Y driver is based on a non-choosing electrical potential difference. It is the group (it is not necessary to be necessarily 1 set) of the positive/negative electrical potential difference with the same absolute value about a selection electrical potential difference. By making X driver the configuration which moves by the positive/negative electrical potential difference with the same absolute value (it is not necessary to be necessarily 1 set) similarly as a configuration which moves The value of the reference voltage which the switching circuit 633 of comparatively high pressure-proofing which changes electrical potential differences V1 and V4 becomes unnecessary, and is applied to the end of a resistor 631 becomes good on the fixed electrical potential difference of arbitration. For example, reference voltage may be set as the electrical potential difference of the middle point of electrical potential differences V0 and V5.

[0060] Furthermore, when FR signal equivalent to the Y driver 12 of drawing 6 changes, even if it is Y driver of a configuration of that a non-choosing electrical potential difference changes from an electrical potential difference V1 (4) to V4 (1) When FR signal changes, also by making correction voltage a circuit (for example, switch of low pressure-proofing which short-circuits resistor 631) configuration which is not generated compulsorily, the value of the reference voltage which a switching circuit 633 becomes unnecessary and is applied to the end of a resistor 631 becomes good on the fixed electrical potential difference of arbitration.

[0061] Moreover, although correction voltage is added to the driver voltage wave of a signal electrode in this example, the same effectiveness as an example 2 is acquired by preparing the inversed amplification which reverses the polarity of the electrical potential difference which the voltage follower circuit 632 outputs, and adding this to the driver voltage wave of a scan electrode by making this output voltage into correction voltage.

[0062] The distortion of the output wave of [an example 4] and also Y driver thru/or the voltage waveform on a scan electrode is generated when a current flows to Y driver and a scan electrode. And this current flows into a power circuit through Y driver. Therefore, distortion can be presumed by detecting the current which flows to this power circuit. Change, now ** are good in the electrical potential difference supplied to X driver by this.

[0063] This is explained in more detail using drawing 7 . Drawing 7 shows the configuration of this example. Except power circuit 73, it is the same as the configuration of drawing 1 , and explanation is

omitted by a diagram. Since components other than resistors 731 and 732, a differential amplifying circuit 733, and 734 are still the same as the power circuit 13 of drawing 1 in the power circuit 73 of drawing 6, explanation is omitted. Resistors 731 and 732 have minute resistance by current detection resistance, and the both ends of a resistor are made to generate the electrical potential difference proportional to the current which flows to this resistor. Differential amplifying circuits 733 and 734 output the electrical-potential-difference difference generated to the both ends of resistors 731 and 732, respectively to an electrical-potential-difference adder circuit. this -- an electrical potential difference -- a difference -- being based -- an electrical potential difference -- an adder circuit -- 137 - 140 -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- generating . The above configuration and actuation are carried out.

[0064] Therefore, since the same actuation as an example 1 is carried out, while acquiring the same effectiveness, the reference voltage changeover switch 132 which was required of the example 1, the input voltage change control circuit 133, and the input voltage changeover switch 135 can simplify needlessness and a collapsibility circuit.

[0065] Moreover, the same effectiveness as an example 2 is acquired by adding this to the driver voltage wave of a scan electrode by making into correction voltage the electrical potential difference which reversed the polarity of the electrical potential difference which differential amplifying circuits 733 and 734 output.

[0066] In addition, although this example showed how to detect the current of a non-choosing electrical potential difference The electrical potential difference impressed to each signal electrode distortion which each signal electrode generates in the driver voltage wave on a scan electrode (non-choosing electrical potential difference) From a lighting electrical potential difference to an astigmatism LGT electrical potential difference Since it is exactly the total of a current which flows to each signal electrode when changing from an astigmatism LGT electrical potential difference to a lighting electrical potential difference For example, distortion generated in the driver voltage wave on a scan electrode (non-choosing electrical potential difference) also by the resistor of a minute value etc. detecting respectively the current of the lighting electrical potential difference supplied to the X driver 11 of drawing 7 and an astigmatism LGT electrical potential difference, and adding it can be presumed. It can also make it easy to make correction voltage and the same effectiveness is acquired by this.

[0067] In the [example 5] examples 1-4, the display unevenness generated in the array direction of the signal electrode of a liquid crystal panel was canceled. Here, the example which cancels the display unevenness (this display unevenness is henceforth called weft length.) generated in the array direction of the scan electrode of a liquid crystal panel next is shown. Although JP,2-89,A for which the writer applied has explained this weft length in detail If it says simply, when more display dots on each scan electrode will light up In order to become blunt mostly by the time of the capacity of the capacitor which the display dot on this scan electrode makes becoming large, and the driver voltage wave of a scan electrode changing from a non-choosing electrical potential difference to a selection electrical potential difference, the effective voltage impressed to the display dot on that scan electrode becomes small, and weft length occurs. That is, weft length is prescribed by the wave-like amount of provincial accents when changing to a selection electrical potential difference.

[0068] Therefore, this display unevenness is cancelable by forming an electrical-potential-difference detection electrode on the substrate with which the signal electrode of a liquid crystal panel is formed, carrying out capacity coupling of this electrical-potential-difference detection electrode by the signal electrode and the liquid crystal layer, detecting total of electrical-potential-difference change of a scan electrode, and changing the selection electrical potential difference which presumes the provincial accent on a scan electrode and is supplied to Y driver from this result.

[0069] This is explained in more detail using drawing 8. Drawing 8 shows the configuration of this example. Except liquid crystal panel 10b and power circuit 83, it is the same as the configuration of drawing 1, and explanation is omitted by a diagram.

[0070] Liquid crystal panel 10b newly adds the electrical-potential-difference detection electrode XD on the substrate 102 of the liquid crystal panel 10 of drawing 1 by drawing 8. The electrical-potential-

difference detection electrode XD is provided so that all the scan electrodes Y1-Y6 may be countered, as shown in drawing.

[0071] 83 is a power circuit in drawing 8, and since components other than 831 - 833 are the same as the power circuit 13 of drawing 1, explanation is omitted. 831 reverses the electrical potential difference which the voltage follower circuit 632 outputs in inversed amplification. 832 and 833 carry out the same circuitry and the same function as an adder 137 of drawing 1 with an adder.

[0072] It has the above composition. Here, liquid crystal panel 10b shows the voltage waveform on the electrical potential difference which the voltage follower circuit 632 in the case of performing a display which the display dot on the scan electrode Y3 turned on, and the display dot on other scan electrodes has turned on few outputs, and each scan electrode typically to drawing 9 R> 9. [many] As for the voltage waveform to which the voltage follower circuit 632 outputs 901 by a diagram, and 902-904, the voltage waveform on the scan electrode Y2 - Y4 is shown respectively. In addition, 902-904 are the voltage waveforms at the time of presupposing that correction voltage is not temporarily added to the drive wave of a scan electrode. Here, a voltage waveform 901 serves as total of change of all the voltage waveforms of scan electrode Y1-6, and the part which a sequential selection electrical potential difference changes to scan electrode Y2-4, and is impressed to them by a diagram is shown.

[0073] Since the voltage waveform 903 on the scan electrode Y3 becomes blunt greatly and it becomes a selection electrical potential difference when the scan electrode which a selection electrical potential difference impresses to Y3 changes from the scan electrode Y2, as drawing 9 shows, the big differential wave of the magnitude as this also with the almost same electrical potential difference 901 which the voltage follower circuit 632 outputs is generated. And since the voltage waveform 904 on the scan electrode Y4 becomes a selection electrical potential difference, without hardly becoming blunt when the scan electrode which a selection electrical potential difference impresses to Y4 changes from the scan electrode Y3, a differential wave also with the small electrical potential difference 901 which the voltage follower circuit 632 outputs is generated.

[0074] Here, the polarity reversals of the output of the voltage follower circuit 632 are carried out in inversed amplification 831, and it is added to a selection electrical potential difference with adders 832 and 833 by making this into correction voltage.

[0075] Therefore, since the selection electrical potential difference to which bigger correction voltage was added impresses when the voltage waveform 903 on the scan electrode Y3 tends to become blunt greatly and it is going to become a selection electrical potential difference, it is right set so that a selection electrical potential difference may be reached more early in fact.

[0076] Therefore, how to become blunt when changing from a non-choosing electrical potential difference to a selection electrical potential difference mostly, without being based on the number which has turned on the display dot on each scan electrode becomes almost the same, and can prevent weft length.

[0077] [Example 6] Further, although a voltage waveform becomes blunt greatly when many [a selection electrical potential difference is impressed by a certain scan electrode, and many display dots on this scan electrode are on and] since the distortion of the output wave of Y driver thru/or the voltage waveform on a scan electrode is generated when a current flows to Y driver and a scan electrode, the current of many [this] is not flowing to this scan electrode. Therefore, distortion can be presumed by detecting the current which flows to this scan electrode, and the current which flows into the part which in other words generates the selection electrical potential difference of a power circuit. By this, the electrical potential difference supplied to Y driver may be changed.

[0078] This is explained in more detail using drawing 10. Drawing 10 shows the configuration of this example. Except power circuit 103, it is the same as the configuration of drawing 7, and explanation is omitted by a diagram. Since components other than resistors 1031 and 1032, differential amplifying circuits 1033 and 1034, an adder 1035, and 1036 are still the same as the power circuit 73 of drawing 7 in the power circuit 103 of drawing 10, explanation is omitted. Resistors 1031 and 1032 have minute resistance by current detection resistance, and the both ends of a resistor are made to generate the electrical potential difference proportional to the current which flows to this resistor. Differential

amplifying circuits 1033 and 1034 output the electrical potential difference which acted as arbitration of the electrical-potential-difference difference generated to the both ends of resistors 1031 and 1032, respectively to an electrical-potential-difference adder circuit, respectively. The electrical-potential-difference adder circuits 1035 and 1036 add these electrical-potential-difference differences to electrical potential differences V0 and V5, respectively, and electrical-potential-difference V0' and V5' are generated. The above configuration and actuation are carried out.

[0079] Therefore, since a big current flows to resistors 1031 and 1032 when a selection electrical potential difference is impressed by a certain scan electrode and the voltage waveform on this scan electrode considers as a raw wave greatly, electrical-potential-difference V0' and V5' become the electrical potential difference of a big absolute value from electrical potential differences V0 and V5 to a non-choosing electrical potential difference. Therefore, the big provincial accent of the voltage waveform on this scan electrode is canceled. The same effectiveness as an example 5 is acquired by this.

[0080] In the [example 7] example 3, the electrical-potential-difference detection electrode was formed one on the substrate with which the scan electrode of a liquid crystal panel is formed, capacity coupling of this electrical-potential-difference detection electrode was carried out by the signal electrode and the liquid crystal layer, total of electrical-potential-difference change of a signal electrode was detected, and the electrical potential difference which presumes the distortion on a scan electrode and is supplied to X driver from this result was changed. However, if the number of scan electrodes increases, it puts in another way and the die length of each signal electrode becomes long, it may be difficult for the degrees of electrical-potential-difference change to differ in the part near X driver of each signal electrode, and a far part, and to presume the distortion on a scan electrode correctly. In such a case, what is necessary is to generate the correction voltage made into the existing suitable function which makes these electrical potential differences a variable, and just to add this correction voltage to the drive wave of a signal level by this, if weighting of the electrical potential difference which forms two or more electrical-potential-difference detection electrodes, and these electrical-potential-difference detection electrodes detect is carried out suitably and it is respectively put in another way.

[0081] This is explained in more detail using drawing 11. Drawing 11 shows the configuration of this example. Except liquid crystal panel 10c and power circuit 113, it is the same as the configuration of drawing 1, and explanation is omitted by a diagram.

[0082] By drawing 11, liquid crystal panel 10c is provided in the up-and-down both-sides section so that all the signal electrodes X1-X6 may newly on the substrate 101 of the liquid crystal panel 10 of drawing 1 be countered in the electrical-potential-difference detection electrode 1 and YD 2, as shown in drawing 1, respectively. When the effects which make it generate from a signal electrode X1 here on the scan electrode by the electrical-potential-difference change on Xsix differ for every signal electrode, the width of face of the electrical-potential-difference detection electrode YD may be formed so that it may become large, as it hopes that it is not uniform, for example, becomes the right from the left.

[0083] 1130 is a power circuit in drawing 11, and since components other than 6311, 6312, 6321, 6322, 1131 - 1134 are the same as the power circuit 13 of drawing 1, explanation is omitted. 6311 and 6312 form a differential circuit by the capacitor which the electrical-potential-difference detection electrode 1 and YD 2 becomes from the signal electrodes X1-X6 which counter this by the resistor, respectively. 6321 and 6322 lower an impedance and output the electrical potential difference generated in the electrical-potential-difference detection electrode 1 and YD 2 in a voltage follower circuit, respectively. In addition, this circuit may not necessarily be the noninverting amplifier of one 1 time the scale factor [scale factor of arbitration instead of an amplification factor] of this. 1131 - 1134 -- an adder -- an electrical potential difference -- V -- zero -- V -- two -- V -- three -- V -- five -- two -- a ** -- voltage - a follower -- a circuit -- 6321 -- two -- outputting -- an electrical potential difference -- adding -- respectively -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- generating .

[0084] The above configuration and actuation are carried out. Here, the example of 1 configuration of adders 1131-1134 is shown in drawing 12. By a diagram, 1201 forms 1202, a resistor and 1203 form

the differential circuit of 2 inputs by the capacitor, and 1204 is a voltage follower circuit by the operation amplifying circuit. Moreover, a terminal 1 and Vin 2 inputs the electrical potential difference which the voltage follower circuits 6321 and 2 of drawing 11 output, respectively, and Terminal Vref inputs one electrical potential difference of the electrical potential differences V0, V2, V3, and V5. drawing 12 -- a terminal -- Vout -- voltage - a follower -- a circuit -- 203 -- an output -- drawing 11 -- an electrical potential difference -- V -- zero -- ' -- V -- two -- ' -- V -- three -- ' -- V -- five -- ' -- corresponding . Here, since the electrical potential difference which the voltage follower circuits 6321 and 2 inputted into Terminal Vin by drawing 12 output is almost close to a differential wave, it can output the electrical potential difference which applied the electrical potential difference of a terminal 1 and Vin 2 to the electrical potential difference of Terminal Vref in approximation from the voltage follower circuit 1204 by connecting these electrical potential differences to the terminal 1 and Vin 2 of the differential circuit which consists of resistance 1201 and capacitors 1202 and 1203.

[0085] Here, it was equalized, when electrostatic capacity of capacitors 1202 and 1203 was made the same, and becoming the correction voltage by which weighting was carried out equally and putting in another way the electrical potential difference of a terminal 1 and Vin 2 as a result. Moreover, contribution to the correction voltage of electrical-potential-difference change of the electrical-potential-difference detection electrode YD2 can be enlarged by making electrostatic capacity of 1203 larger than a value 1202 which is different in the electrostatic capacity of these two capacitors, for example, a capacitor.

[0086] The electrostatic capacity of these capacitors 1202 and 1203 can be easily set up in an experiment etc. Moreover, contribution to correction voltage can be similarly enlarged by setting up the electrostatic capacity of capacitors 1202 and 1203 similarly, and making YD2 broader than the electrical-potential-difference detection electrode YD1 of drawing 11 , for example.

[0087] Therefore, since distortion generated in the drive wave on a scan electrode by two or more-izing [carrying out the same actuation as an example 3, and / an electrical-potential-difference detection electrode] further was detected more correctly, display unevenness was more cancelable.

[0088] In addition, the effectiveness same also about weft length as this example is acquired by forming two or more electrical-potential-difference detection substrates in the both-sides section on either side like the example 5 over an example 3, so that it may counter on the substrate with which the signal electrode is formed at all the scan electrodes Y1-Y6, and making a power supply section into the same circuitry.

[0089] Although the electrical potential difference of the function which made the electrical potential difference which forms two or more electrical-potential-difference detection electrodes on the substrate with which the scan electrode of a liquid crystal panel is formed, and is generated in these electrical-potential-difference detection electrodes two or more variables was used as one correction voltage in the [example 8] example 7 For example, when total of change of the signal electrode on the left-hand side of a liquid crystal panel of a driver voltage wave completely differs from total of change of a right-hand side signal electrode of a driver voltage wave, the direction which applied correction voltage which is different in these signal electrodes can cancel display unevenness more. Therefore, display unevenness is further improvable by adding the correction voltage to the driver voltage wave for every signal electrode or scan electrode which the electrical-potential-difference detection electrode which is made to generate two or more correction voltage from electrical-potential-difference change obtained from two or more electrical-potential-difference detection electrodes, and is made to generate a certain correction voltage about such correction voltage intersects according to an individual. This is explained in more detail using drawing 13 . The example of 1 configuration of this example is shown in drawing 13 .

[0090] Since the Y driver 12 carries out the same configuration and the actuation as Y driver of drawing 1 , it omits explanation by a diagram.

[0091] 10d is a liquid crystal panel in drawing 13 , and as the electrical-potential-difference detection electrode 1 and YD 2 newly on the substrate 101 of the liquid crystal panel 10 of drawing 1 shows in drawing, it is compared by each, and it has prepared in the upper edge part so that some signal electrodes X1-X6 may be countered respectively. Here, the comparison part of the electrical-potential-

difference detection electrode 1 and YD 2 is shared between this example with the signal electrode (this example signal electrodes X2-X5) used as a wedge shape, and crosses. However, it not necessarily compares and there is no need that the section shares with the same signal electrode and crosses. It is not necessary to separate two more electrical-potential-difference detection electrodes 1 and YD 2. That is, you may make it have connected too hastily.

[0092] 11L, 11M, and 11R are X drivers, and except that the configuration numbers of bits of each circuit of the X driver 11 of drawing 1 and the interior differ, they carry out the same configuration and actuation. And the electrical potential difference of an electrical-potential-difference configuration different, respectively is supplied to these X drivers 11L, 11M, and 11R, and a driver voltage wave is respectively outputted with this electrical potential difference.

[0093] 133 is a power circuit, and since the configuration and actuation of those other than 1331 - 1333 are the same as the power circuit 1130 of drawing 11, explanation is omitted.

[0094] 1331 and 1333 consist of an adder shown by drawing 2 by the adder group, and are prepared corresponding to electrical potential differences V0, V2, V3, and V5.

[0095] 1332 is an adder group, and this adder consists of an adder shown by drawing 12 R> 2, and is formed corresponding to electrical potential differences V0, V2, V3, and V5.

[0096] The electrical potential difference which the adder groups 1331, 1332, and 1333 output is supplied to the X drivers 11L, 11M, and 11R, respectively.

[0097] Since it has the above composition, in the electrical-potential-difference detection electrode YD1, total of electrical-potential-difference change of the driver voltage wave to signal-electrode X1-5 occurs. Here, weighting of electrical-potential-difference change of a driver voltage wave is small, so that it goes to X5 from a signal electrode X1, since the point of the electrical-potential-difference detection electrode YD1 serves as a wedge shape. Although total of the electrical-potential-difference change of the driver voltage wave to signal-electrode X1-5 also to the electrical-potential-difference detection electrode YD2 occurs similarly, weighting of electrical-potential-difference change of a driver voltage wave is small, so that it goes to X1 from a signal electrode X5.

[0098] Therefore, the voltage follower circuit 6321 mainly outputs total of electrical-potential-difference change of the signal electrode on the left-hand side of 10d of liquid crystal panels of a driver voltage wave, and the voltage follower circuit 6322 mainly outputs total of electrical-potential-difference change of a right-hand side signal electrode of a driver voltage wave.

[0099] Here, the output voltage of the voltage follower circuit 6321 is supplied to the adder group 1331 as correction voltage, and the output of the adder group 1331 is supplied to X driver 11L. Similarly, the output voltage of the voltage follower circuit 6322 is supplied to the adder group 1333 as correction voltage, and the output of the adder group 1333 is supplied to X driver 11R. And the output of the voltage follower circuits 6321 and 6322 is supplied to the adder group 1332 as two correction voltage, and the adder group 1332 outputs the electrical potential difference which added the correction voltage which equalized these two correction voltage to X driver 11M.

[0100] Since the above actuation is carried out, the correction voltage by total of change of a driver voltage wave by which many weighting to change of the signal electrode of this left-hand side of a driver voltage wave was carried out to the driver voltage wave of the signal electrode on the left-hand side of 10d of liquid crystal panels will be added, the correction voltage by which many weighting to change of a right-hand side signal electrode of a driver voltage wave was carried out to the driver voltage wave of a left-hand side signal electrode will be added, and the correction voltage which right and left equalized will be added in the center section.

[0101] therefore -- the driver voltage wave of each signal electrode -- abbreviation -- the optimal correction voltage was able to be added separately and was able to cancel display unevenness further.

[0102] In addition, although the adder groups 1331 and 1333 were used as the adder shown by drawing 2 in this example, it considers as the adder shown by drawing 12, and two outputs of the voltage follower circuits 6321 and 6322 are inputted like the adder group 1332, and with the electrostatic capacity of the capacitors 1202 and 1203 of drawing 12, the amount contributed of these two input voltage may be set up suitably, and may be outputted.

[0103] Moreover, at this example, although the number of different correction voltage was set to 3, this may be suitably fluctuated in the magnitude of a liquid crystal panel etc.

[0104] Furthermore, although this example showed the approach which used the electrical-potential-difference detection electrode For example, the lighting electrical potential difference supplied to these X drivers about each of X driver 11L of drawing 13 , and M and R, Also by the resistor of a respectively minute value etc. detecting the current of an astigmatism LGT electrical potential difference respectively, and adding it, two or more of the same correction voltage as this example can be obtained, and the same effectiveness as this example is acquired by performing same amendment using this.

[0105] As mentioned above, display unevenness was able to be further canceled by making correction voltage which adds that it stated into the correction voltage which changed with places in which the liquid crystal panel of a signal electrode is located.

[0106] Although the electrical potential difference of the function which made the electrical potential difference which forms two or more electrical-potential-difference detection electrodes on the substrate with which the scan electrode of a liquid crystal panel is formed, and is generated in these electrical-potential-difference detection electrodes two or more variables was used as three correction voltage in the [example 9] example 8 for example, the electrical potential difference which forms one electrical-potential-difference detection electrode, and is generated in this electrical-potential-difference detection electrode -- since -- three correction voltage is generated and one correction voltage in the driver voltage wave of the signal electrode according to individual may be added. For example, when the terminal which impresses the driver voltage wave of the scan electrode of a liquid crystal panel in a writer's etc. experiment was in left-hand side, by adding the correction voltage which amplified greatly the correction voltage which amplified small the electrical potential difference obtained from one electrical-potential-difference detection electrode to the signal electrode located in the left-hand side of a liquid crystal panel to the signal electrode located in the right-hand side of a liquid crystal panel showed experimentally that display unevenness was solved more. This is shown in drawing 14 . Drawing 14 shows the example of 1 configuration of this example.

[0107] 10a has a liquid crystal panel and the composition as drawing 6 with 12 [same at Y driver] by a diagram, and 11L, and M and R have the same composition as drawing 13 by X driver.

[0108] Further 143 has the same composition as the power circuit 63 of drawing 6 in the power circuit except 1431 - 1433. Then, these explanation is omitted.

[0109] It consists of adders which show 1431-1433 to drawing 2 by the adder group by drawing 14 , respectively. However, the capacity of the capacitor 202 of drawing 2 $R > 2$ is small by the adder group 1431, is large at 1433, and takes a value in the meantime in 1432.

[0110] That is, but, the adder group 1431 has the smallest correction voltage with the same electrical potential difference which joins Terminal Vin added, and it is set up so that 1432 and 1433 may next become the largest.

[0111] Since two or more correction voltage could be generated from the electrical potential difference obtained from the electrical-potential-difference detection electrode since it had become the above configuration and big correction voltage added the further signal electrode from the drive terminal of a scan electrode to the driver voltage wave, display unevenness was able to be canceled further.

[0112] In [example 10] example 3 grade, although the configuration of an electrical-potential-difference detection electrode was not described especially in detail, display unevenness can be further canceled by changing the configuration of an electrical-potential-difference detection electrode depending on the configuration of a liquid crystal panel. This is explained using drawing 15 . Drawing 15 is drawing showing the configuration of a liquid crystal panel. This Fig. is the same except that liquid crystal panel 10a of drawing 14 differs from the configuration of each electrode. Here, the configuration of the scan electrodes Y1-Y6 is carrying out the same configuration as liquid crystal panel 10a, and, as for signals X1-X6, the terminal with which driver voltage is supplied alternately with the upper and lower sides is formed. (In drawing 15 , this terminal is formed for the signal electrode of X1, 3 and 5, and an odd number upwards.) Here, the electrical-potential-difference detection electrode YD is formed so that each signal electrode may be intersected at a part for an upper edge part. And in the part which intersects the

signal electrode of an odd number, the electrical-potential-difference detection electrode YD has narrow width of face, and by the part which intersects the signal electrode of an even number, it is formed so that width of face may become large.

[0113] The electrical-potential-difference detection electrode YD is formed in the above configurations.

[0114] By this, capacity coupling of a signal electrode with the near terminal which driver voltage impresses, and the electrical-potential-difference detection electrode YD becomes small, and capacity coupling of a signal electrode with the far terminal which driver voltage impresses, and the electrical-potential-difference detection electrode YD becomes large. Therefore, the electrical-potential-difference detection electrode YD is made to generate a differential electrical potential difference in small weighting in the location of the electrical-potential-difference detection electrode YD by change of a driver voltage wave on the signal electrode of an odd number with little attenuation, and the change of a driver voltage wave on the signal electrode of the big even number of attenuation makes the electrical-potential-difference detection electrode YD generate a differential electrical potential difference in big weighting.

[0115] Therefore, the electrical-potential-difference detection electrode YD can incorporate equally electrical-potential-difference change of a signal electrode with the far terminal which impresses a driver voltage wave, and a near signal electrode to the electrical-potential-difference detection electrode YD. Since distortion more correctly generated on a scan electrode can be guessed, as a result more exact correction voltage can be generated by this, display unevenness can be canceled further.

[0116] In the [example 11] example 3 grade, the electrical potential difference which amplified the electrical potential difference which the electrical-potential-difference detection electrode detected for the fixed scale factor was made into correction voltage. Here, the electrical-potential-difference difference of an electrical-potential-difference detection electrode and the signal electrode which counters is 0V in general. However, the electrical-potential-difference difference of an actual scan electrode and the signal electrode which counters is about several V in effective voltage. If the effective voltage which generally impresses liquid crystal becomes large, the dielectric constant will become large. This means that the electrostatic capacity of the capacitor which a liquid crystal panel makes becomes large, when many display dots of a liquid crystal panel light up. Therefore, total of electrical-potential-difference change of a signal electrode of a drive wave makes the driver voltage wave on each scan electrode generate but more much same distortion. However, a display does not depend the degree of capacity coupling of an electrical-potential-difference detection electrode and the signal electrode which counters how, but since it is fixed, correction voltage will run short with some of numbers of lighting dots of a display. Therefore, the display which the number of lighting dots is not caused how and does not have display unevenness can be performed by fluctuating the amount of correction voltage with some of numbers of lighting dots of a display. Drawing 1616 explains this. Drawing 16 shows the example of 1 configuration of this example. The configuration of those other than a power circuit 163 and number counting circuit of lighting dots 164 is the same as the configuration of drawing 6, and omits explanation by a diagram. 164 of drawing 16 R> 6 consists of a scaling circuit 1641 and a latch circuit 1642 in the number scaling circuit of lighting dots. It sets enumerated data to 0 and starts counting again at the same time it counts up a scaling circuit 1641 synchronizing with CK signal when a data signal is "1", and it makes a latch circuit 1642 incorporate enumerated data synchronizing with DI signal. The output of a latch circuit 1642 is incorporated by the adjustable amplifier 1631 of a power circuit 163.

[0117] 163 of the configuration of those other than 1631 is the same as that of the configuration of drawing 6 in a power circuit, and omits explanation. 1631 is an amplifying circuit where an amplification factor becomes large, when the numeric value of the number counting circuit 164 of lighting dots becomes large with adjustable amplifier. The example of 1 configuration of this circuit is shown in drawing 17.

[0118] It is drawing, and by the resistor, 173 has the resistance of the one half of 174 and, in an operational amplifier, and 172-175, 174 has [171] the resistance of the one half of 175. 176-178 are respectively connected to resistors 172-175 in the switching circuit at juxtaposition. Although these

resistance and switching circuits are three pieces in this example, this number may be fluctuated suitably. The output of the switching circuit 603 of drawing 16 and the output of the voltage follower circuit 632 are connected to V_{ref} and a V_{in} terminal, respectively. Therefore, the electrical potential difference which the non-inversed amplifying circuit with the amplification factor by the ratio of the resistance of resistance 172 and the resistance between resistors 173 and 175 was formed, and was inputted into the V_{in} terminal on the basis of the electrical potential difference of a V_{ref} terminal is amplified and outputted with this amplification factor. Here, ON/OFF control of the switching circuits 176-178 is carried out for the binary numeric value which is two or more bits which the number scaling circuit 164 of lighting dots outputs. That is, OFF and in the case of "0", it is turned on when a binary numeric value is "1." Moreover, the numeric value of a high order controls a switching circuit 178, and a low-ranking numeric value controls a switching circuit 176. Thereby, if a numeric value becomes large, the resistance between resistors 173 and 175 will become large in proportion to this. Therefore, an amplification factor will become large if the number of lighting dots increases.

[0119] Since it has the above composition, if many display dots of liquid crystal panel 10a light up, the display in which correction voltage also becomes large, and the number of lighting dots does not depend it how, but no display unevenness is can be performed.

[0120] Although correction voltage was added to the electrical potential difference supplied to the X driver 11 by detecting the current which flows on the non-choosing electrical potential difference in a power circuit 73 (V_1 , V_4) in the [example 12] example 4, correction voltage may be added to the electrical potential difference supplied to the Y driver 12. This is explained using drawing 18. Drawing 18 shows the concrete example of 1 configuration of this example. Except power circuit 183, it is the same as the configuration of drawing 1, and explanation is omitted by a diagram. 141 in a power circuit 183, and OP2 and OP3 are still the same as the jack per line of drawing 1 respectively. 1810 and 1840 are electrical-potential-difference amendment circuits which add correction voltage to electrical potential differences V_1 and V_4 , respectively, and are prepared between the electrical-potential-difference dividing network 131 and the Y driver 12. The electrical-potential-difference amendment circuits 1810 and 1840 serve as the same circuitry, and show the concrete example of 1 configuration of the electrical-potential-difference amendment circuits 1810 and 1840 to drawing 19. Although a non-choosing electrical potential difference explains hereafter the period when an electrical potential difference V_1 is used in examples 12-16 here according to FR signal, the same is said of the period when an electrical potential difference V_4 is used. In drawing 19, a V_{in} terminal is a terminal which inputs an electrical potential difference V_1 (or V_4). 1911 is a resistor for current detection and the electrical potential difference proportional to the total of a current which flows to the scan electrode with which a non-choosing electrical potential difference is impressed generates it to the both ends. This electrical potential difference is impressed to the inversed amplification 1912 constituted by the operational amplifier 1913 and resistors 1914 and 1915. The electrical potential difference (this is set to V_d) which an inversed amplifier 1912 outputs can be made almost equal to the electrical potential difference on the scan electrode with which the non-choosing electrical potential difference distorted under the effect of the transient current was impressed by setting the amplification factor of inversed amplification 1912 as a suitable value with the resistance of resistors 1914 and 1915. An operational amplifier 1916 outputs the electrical potential difference (this is set to V_c) made into electrical potential differences [electrical potential difference / from the V_{in} terminal impressed to electrical-potential-difference V_1 impressed to the reversal input of an operational amplifier 1916, and a noninverting input] to the Y driver 12.

[0121] Since the above configuration and actuation are carried out, also when the transient current flows, the electrical potential difference and electrical potential difference V_1 (or electrical potential difference V_4) on the scan electrode which the non-choosing electrical potential difference impressed are maintained at the always same electrical potential difference.

[0122] As mentioned above, by detecting the current which flows on the non-choosing electrical potential difference in a power circuit (electrical potential differences V_1 and V_4), as stated, and adding correction voltage to the non-choosing electrical potential difference supplied to the Y driver 12,

fluctuation of the electrical potential difference on the scan electrode which the non-choosing electrical potential difference impressed could be suppressed, like the example 1, it could be easy and display unevenness was able to be canceled simply.

[0123] There may not be the need that the circuitry of the electrical-potential-difference amendment circuits 1810 and 1840 of the [example 13] example 12 is a configuration shown by drawing 19, and other circuitry is sufficient as it. Here, an example of other circuitry of an electrical-potential-difference amendment circuit is shown in drawing 20. About 1911-1916 of drawing 20, the jack per line of drawing 19 is supported, respectively. 2017 is a capacitor and sets up the time constant τ_1 of inversed amplification 1912 in combination with a resistor 1914. Similarly, 2018 and 2019 set up the time constant τ_2 of the operation amplifying circuit 1916 by the resistor and the capacitor, respectively.

[0124] It has the above composition, and also when the transient current flows on an electrical potential difference V_1 (or V_4) by setting the value of these time constants τ_1 and τ_2 and the amplification factor mentioned above in the example 12 as a suitable value, the effective voltage value per 1LP signal cycle of the electrical potential difference on the scan electrode which the non-choosing electrical potential difference impressed can be made equal to an electrical potential difference V_1 , and there is the same effectiveness as an example 12. Furthermore, since the electrical-potential-difference variation per unit time amount of the output voltage of amplifying circuits 1913 and 1916 became small, it could use the cheap operational amplifier with a low slew rate, and the stability of a circuit was also able to raise it. In addition, although this example described the case where the current of the non-choosing electrical potential difference which flows the inside of a power circuit was detected, also when detecting the current of a selection electrical potential difference, and generating correction voltage using an electrical-potential-difference detection electrode further, the same effectiveness is acquired by taking the same circuitry.

[0125] Although the resistor with minute resistance detected the current which flows all over a power circuit in the [example 14] example 12 and 13 grades, there is no need of not necessarily using a resistor for current detection, and it may use other components. Here, the concrete example of 1 configuration of the electrical-potential-difference amendment circuit at the time of using a transformer for drawing 21 as other components as a substitute of the electrical-potential-difference amendment circuit of the electrical-potential-difference amendment circuits 1910 and 1940 of drawing 19 is shown. The operation amplifying circuit 1916 of drawing 21 is the same as the thing of the jack per line of drawing 19. 2120 is a transformer and consists of a primary coil 2121 and a secondary coil 2122. Here, the same effectiveness as an example 12 was acquired by making the ratio of the number of turns of the primary coil 2121 and the secondary coil 2122 into a suitable value. Furthermore, the number of components was able to be lessened.

[0126] Here, the example of a configuration of other electrical-potential-difference amendment circuits which added the resistor and the capacitor to this example further is shown in drawing 22. 2223 or 2224 resistors and a capacitor are added to the electrical-potential-difference amendment circuit of drawing 21 by drawing 22. By this added resistor and the capacitor, the time constant τ_2 of the operation amplifying circuit 1916 was set up, and the same effectiveness as an example 13 was acquired.

[0127] Although the non-choosing electrical potential difference supplied to the Y driver 12 was mostly changed to real-time so to speak in the [example 15] example 12 - 14 grades, while the same effectiveness as an example 12 is acquired, actuation of an electrical-potential-difference amendment circuit can be carried out to stability, for example by making it the electrical-potential-difference amendment circuit which shows the electrical-potential-difference amendment circuits 1810 and 1840 to drawing 23 in the above-mentioned example 12. That is, as shown in drawing 23, correction voltage is delayed fixed time within this LP signal cycle by inserting the delay elements 2325, such as a swiched capacitor circuit and CCD, between inversed amplification 1912 and the operation amplifying circuit 1916, and it adds to a non-choosing electrical potential difference, and since there is non-real-time feedback while the same effectiveness as an example 12 is acquired, even if it supplies this to the Y driver 12, the actuation which the amendment potential circuit oscillated and was stabilized as it is ***** is obtained. It is applicable also in the examples 13 and 14 to insert this delay element, and

the same effectiveness is acquired.

[0128] For every period of [example 16] 1LP, the momentary-current value which flows on the non-choosing electrical potential difference in the power circuit which appears the time of LP1 period initiation or when time amount predetermined [after initiation] passes, or a peak current value may be detected, and the correction voltage according to the detected current value may be added to a non-choosing electrical potential difference (V1 or V4) as fixed correction voltage of the period of this LP period. Drawing 24 explains this. Drawing 24 is drawing showing the configuration of the electrical-potential-difference amendment circuit of drawing 18. 1911-1915 are the same as the jack per line of drawing 19. It is the circuit which carries out the sample of the electrical potential difference Vd which 2426 is a sample & hold circuit and outputs LP signal or LP signal from inversed amplification 1913 with the signal which delayed only predetermined time amount corresponding to the transient current, and holds it by drawing 24 on the basis of the output voltage Vc of the operation amplifying circuit 1916. That is, the electrical potential difference which becomes $dV = Vd - Vc$ is held.

[0129] Therefore, since $Vc + dV$ is impressed by the noninverting input of the operation amplifying circuit 1916, the said LP period output of the fixed electrical potential difference which becomes V1 (V4)-dV is carried out.

[0130] Carry out the above actuation and the held electrical potential difference Vd Effective voltage per period of 1LP of the electrical potential difference on the scan electrode which the non-choosing electrical potential difference impressed - since it is proportional to V1 (V4), by setting the amplification factor of inversed amplification 1912 as a suitable value Also when the transient current occurred, it became possible to make equal to an electrical potential difference V1 (V4) effective voltage per period of 1LP of the electrical potential difference on the scan electrode which the non-choosing electrical potential difference impressed, and the same effectiveness as an example 12 was acquired.

[0131] In addition, although this example described the case where the current of the non-choosing electrical potential difference which flows the inside of a power circuit was detected, also when detecting the current of a selection electrical potential difference, and generating correction voltage using an electrical-potential-difference detection electrode further, the same effectiveness is acquired by taking the same circuitry.

[0132] [Example 17] Although amendment of the electrical potential difference on the scan electrode with which the non-choosing electrical potential difference was impressed by changing the correction voltage added to the non-choosing electrical potential difference supplied to the Y driver 12, or electrical-potential-difference actual value was performed in the above-mentioned example 16 Although not stated for details, for example, the current of the non-choosing electrical potential difference of a power circuit as well as an example 16 is detected, and also when only the time amount according to this detected current value adds predetermined correction voltage, the same effectiveness as an example 17 is acquired. Moreover, also when this detects the current of a selection electrical potential difference as well as an example 16, and generating correction voltage using an electrical-potential-difference detection electrode further, the same effectiveness is acquired by taking the same circuitry.

[0133] Although only the liquid crystal panel of the structure where a scan electrode and a signal electrode impress a driver voltage wave from one edge has been described until now [[example 18]], it can be adapted in an above-mentioned example also about the liquid crystal panel of the structure of impressing both edge driver voltage waves about both a scan electrode, and both [either or]. Moreover, in the example which prepares an electrical-potential-difference detection electrode and generates correction voltage, the terminal which takes out the electrical potential difference of an electrical-potential-difference detection electrode may also form the terminal of an electrical-potential-difference detection electrode in not only one edge but a side with the driver voltage terminal of circuitry to which it detects from both ends or a scan electrode, and a signal electrode, and the opposite side. Furthermore, an electrical-potential-difference detection electrode may be formed near the side of ***** , and if a display is not hindered by it, it may be formed in a central part.

[0134] It is also easy to compound and use some of the examples 1-17 furthermore, for example, the display unevenness of both warp length and weft length can be canceled by compounding an example 3

and an example 5.

[0135] Although the case of the liquid crystal panel which 1 set of two or more signal electrode and two or more scan electrodes cross mutually on one pair of substrates, and makes a display dot from this examples 1-17 further again was explained Also about the liquid crystal panel with which 2 sets of two or more signal electrodes and 2 sets of two or more scan electrodes cross for each other and each class on one pair of substrates, and make a display dot, and the liquid crystal panel of 2 so-called screen drives The same effectiveness is acquired by adding the correction voltage according to each screen to the supply voltage of X which drives each screen thru/or Y driver. And as an FR signal which supplies the signal which reversed FR signal supplied to X thru/or Y driver which drives one screen to X thru/or Y driver which drives the screen of another side, by supplying, -izing of a part of circuitry can be carried out [****], and circuitry can be simplified at this time. Namely, since the screen of another side uses V5 (0), V1 (4), V0 (5), and V2 (3) when one screen uses V0 (5), V4 (1), V5 (0), and V3 (2) as selection, un-choosing, lighting, and an astigmatism LGT electrical potential difference For example, when one screen uses V1 in the case of the approach of adding correction voltage to a non-choosing electrical potential difference The correction voltage according to the display of one screen is added to V1, and while supplying Y driver which drives this screen, the correction voltage according to the display of the screen of another side can be added to V4, and Y driver which drives this screen can be supplied. Therefore, an amendment potential circuit is sharable.

[0136] [Example 19] Although the electrical-potential-difference equalization drive approach has mainly been explained in addition to an example on these specifications in order to simplify explanation The drive approach that the electrical potential difference impressed to a signal electrode during the period which a selection electrical potential difference impresses to a scan electrode changes (For example, the gradation method of presentation by the so-called Pulse Density Modulation which the time amount which a lighting electrical potential difference and an astigmatism LGT electrical potential difference impress fluctuates), An above-mentioned example has the effectiveness which cancels display unevenness also about the approach of supplying and driving the driver voltage wave which becomes the drive approach, scan electrode, or signal electrode which impresses a selection electrical potential difference to two or more scan electrodes at coincidence from many voltage levels.

[0137] The display quality of electronic equipment can be raised by using any of examples 1-19, or a display for the electronic equipment, for example, a personal computer, which needs a [example 20] display function, a word processor, an electronic notebook, etc.

[0138]

[Effect of the Invention] As stated above, by detecting electrical-potential-difference change or current change of a part with a liquid crystal display system, supposing distortion generated on the electrode of a liquid crystal panel, correction voltage was generated by this and display unevenness has been easily improved by adding this correction voltage to a driver voltage wave. That is, the circuit which calculates a deformation amount became unnecessary from the indicative data, the liquid crystal display which gives an indication high-definition by very simple circuitry could be offered, and the display of the electronic equipment using this display was able to become still more nearly high-definition, and small lightweight-ization was able to be attained. And since correction voltage was generated by this supposing distortion generated on the electrode of a liquid crystal panel by detecting electrical-potential-difference change or current change of a part with a liquid crystal display system, display unevenness could be improved, without asking the drive approach of driving a liquid crystal panel.

[Translation done.]

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CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
 [Section partition] The 2nd partition of the 6th section
 [Publication date] April 27, Heisei 13 (2001. 4.27)

[Publication No.] JP,6-27899,A
 [Date of Publication] February 4, Heisei 6 (1994. 2.4)
 [Annual volume number] Open patent official report 6-279
 [Application number] Japanese Patent Application No. 4-307323
 [The 7th edition of International Patent Classification]

G09G 3/36

[FI]

G09G 3/36

[Procedure revision]
 [Filing Date] September 16, Heisei 11 (1999. 9.16)
 [Procedure amendment 1]
 [Document to be Amended] Specification
 [Item(s) to be Amended] The name of invention
 [Method of Amendment] Modification
 [Proposed Amendment]
 [Title of the Invention] It is the drive approach of liquid crystal equipment to liquid crystal equipment and an electronic equipment list.
 [Procedure amendment 2]
 [Document to be Amended] Specification
 [Item(s) to be Amended] Claim
 [Method of Amendment] Modification
 [Proposed Amendment]
 [Claim(s)]
 [Claim 1] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
 Liquid crystal equipment characterized by providing a detection means to detect change of the difference of the driver voltage supplied to said scan electrode, and the electrical potential difference

supplied to said scan electrode drive circuit, and an amendment means to supply the correction voltage according to change of said difference which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Claim 2] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,

It comes to provide the electrical-potential-difference detection electrode arranged so that said signal electrode or said scan signal electrode may be intersected,

Liquid crystal equipment characterized by providing a detection means to detect the voltage variation generated in said electrical-potential-difference detection electrode, and an amendment means to supply the correction voltage according to said voltage variation which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Claim 3] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,

Liquid crystal equipment characterized by providing a detection means to detect change of the current which flows from said scan electrode drive circuit to said said power circuit, and an amendment means to supply the correction voltage according to change of said current which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Claim 4] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,

Liquid crystal equipment characterized by providing an amendment means to generate said electrical potential difference which a detection means to detect the electrical potential difference of a part with said liquid crystal equipment or change of a current, and said detection means detected, or the correction voltage according to change of a current.

[Claim 5] Electronic equipment characterized by using the liquid crystal equipment of a publication for either among claim 1 thru/or claim 4.

[Claim 6] In the approach of driving the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,

The electrical potential difference of a part with said liquid crystal equipment or change of a current is detected,

The correction voltage according to said change of said detected electrical potential difference or a current is generated,

The drive approach of the liquid crystal equipment characterized by supplying said correction voltage to said scan electrode drive circuit or a signal-electrode drive circuit.

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0007
[Method of Amendment] Modification
[Proposed Amendment]
[0007]

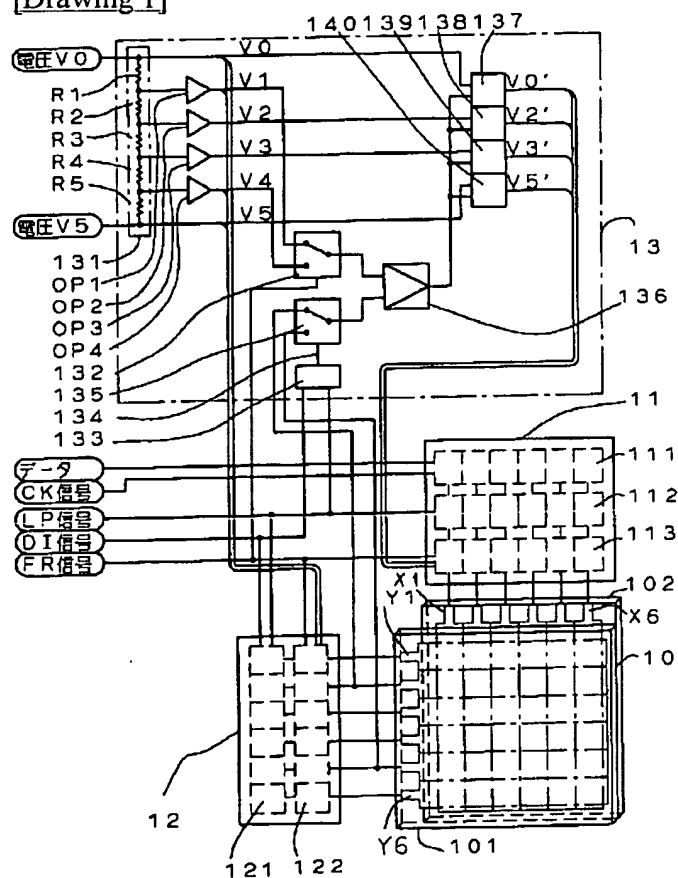
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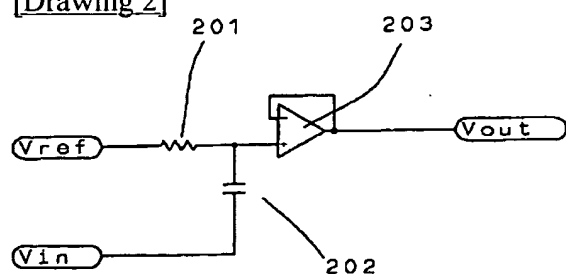
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DRAWINGS

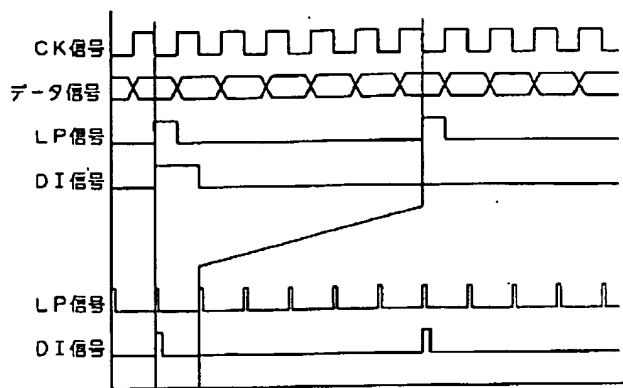
[Drawing 1]



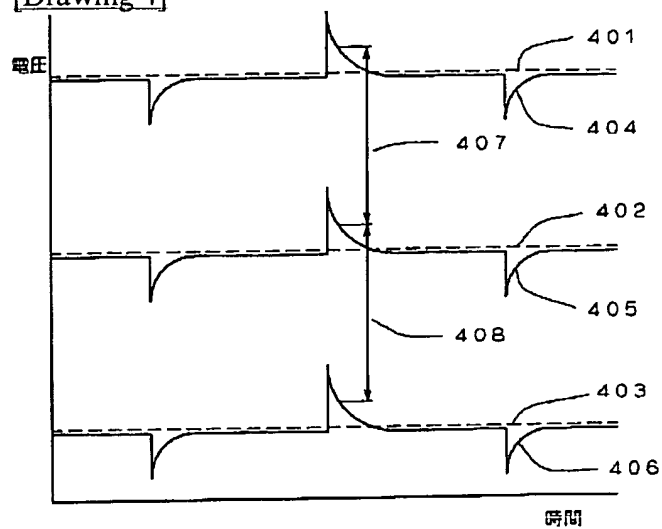
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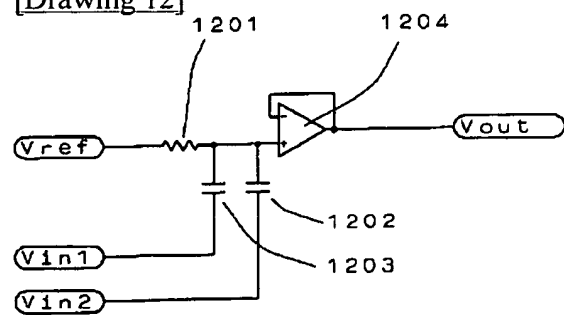
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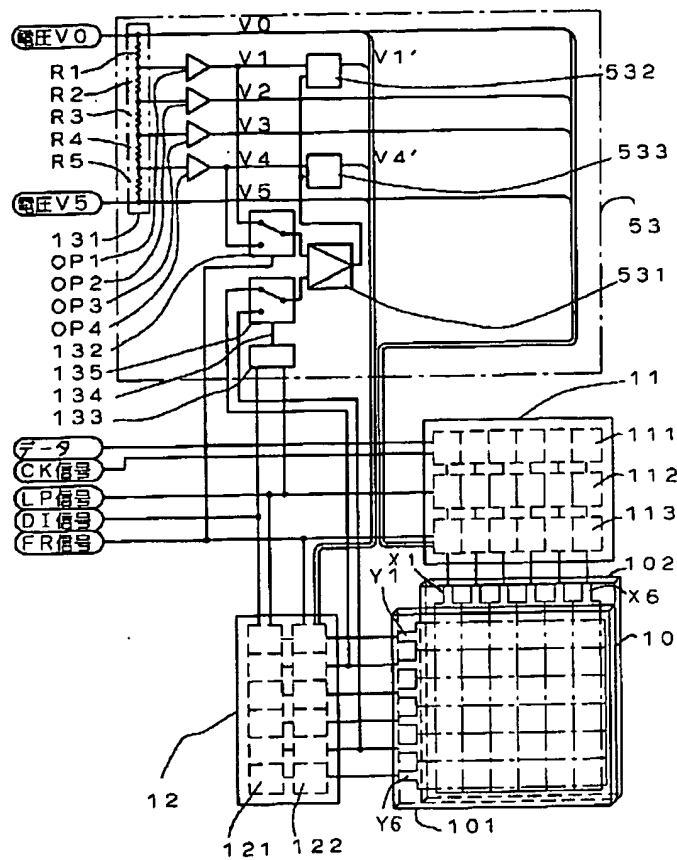
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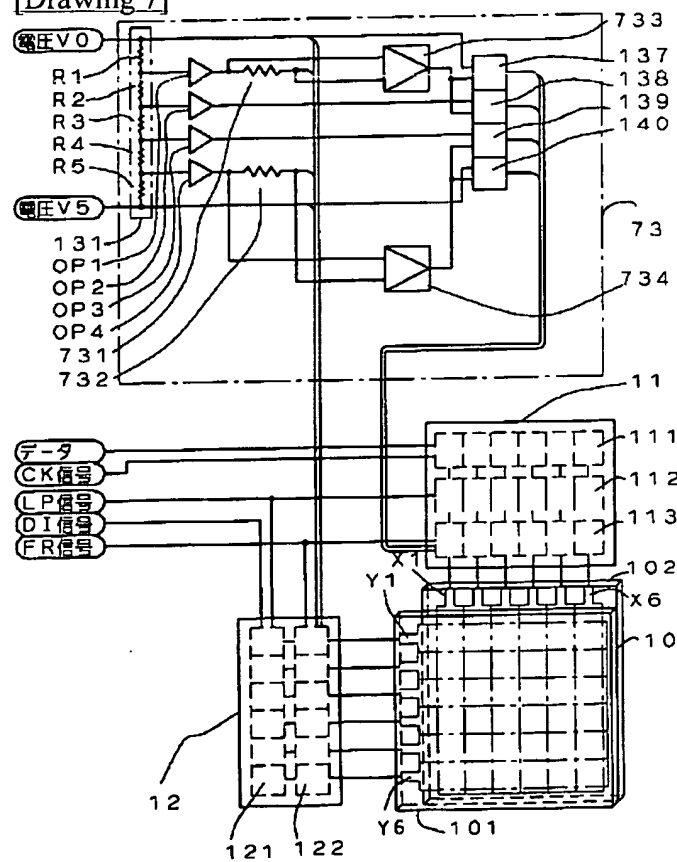
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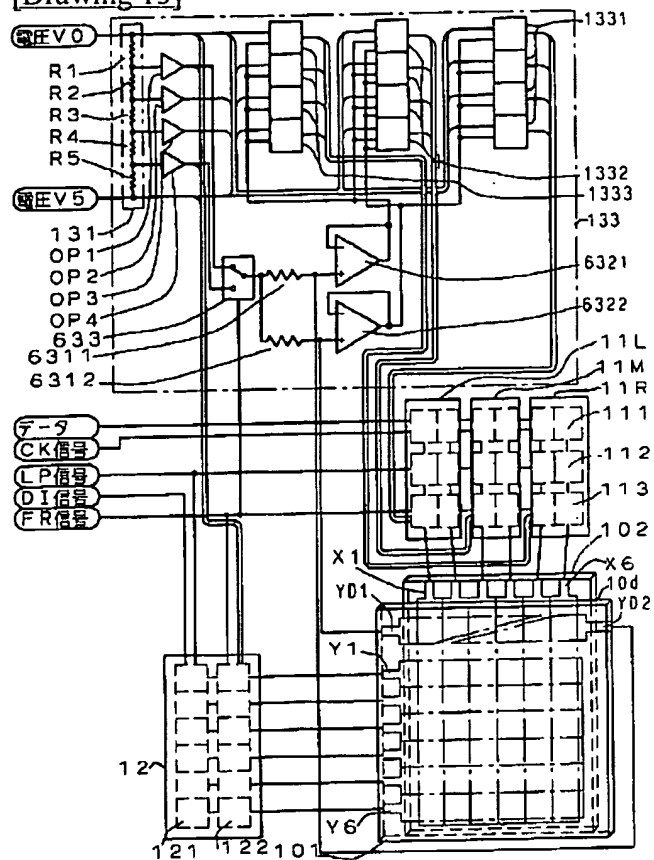
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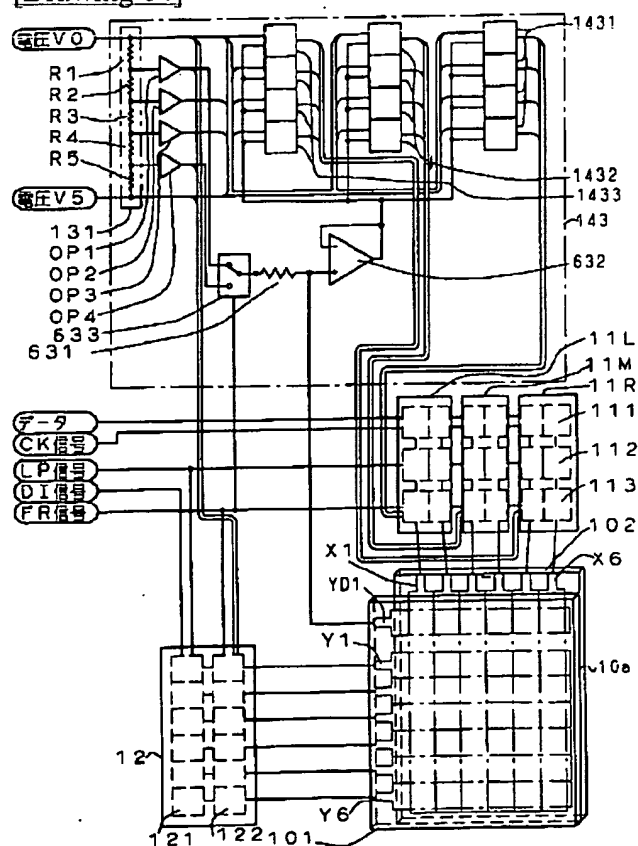
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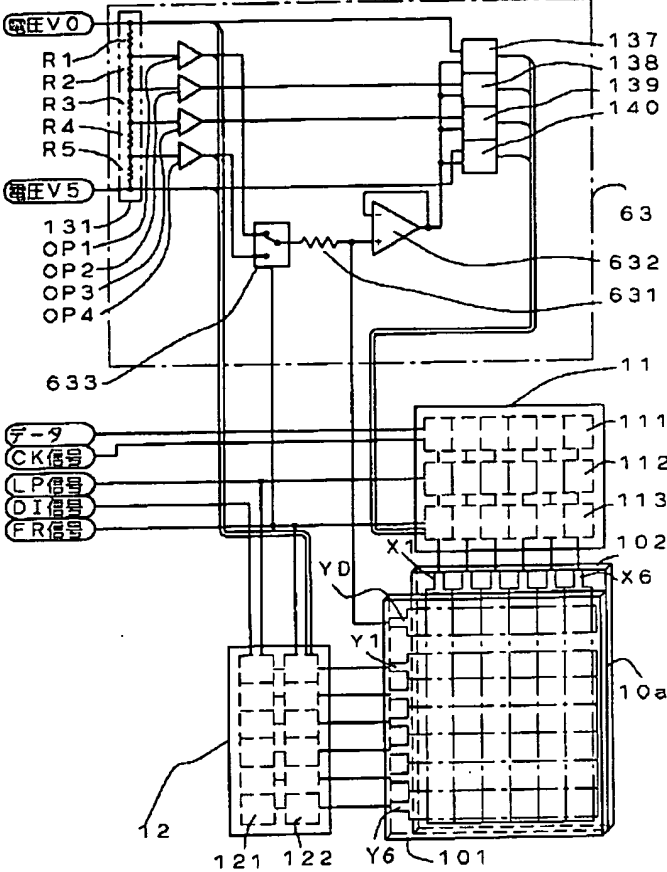
[Drawing 13]



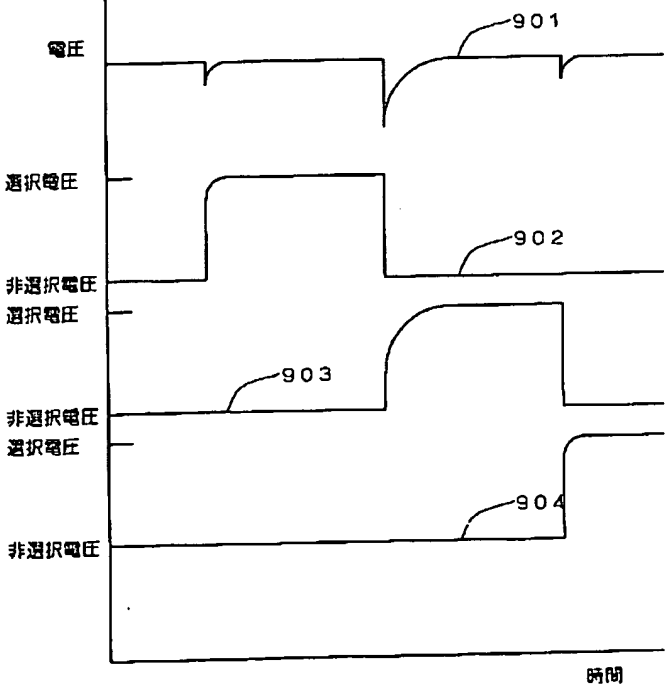
[Drawing 14]



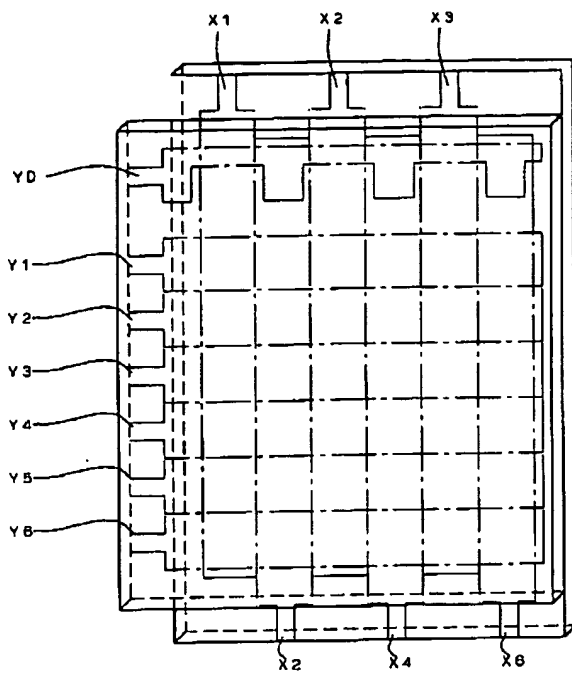
[Drawing 6]



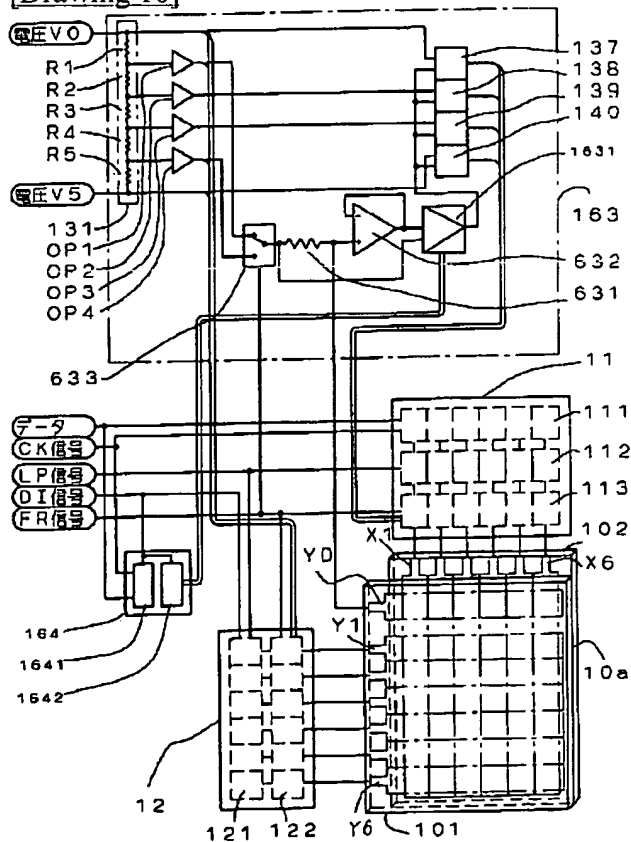
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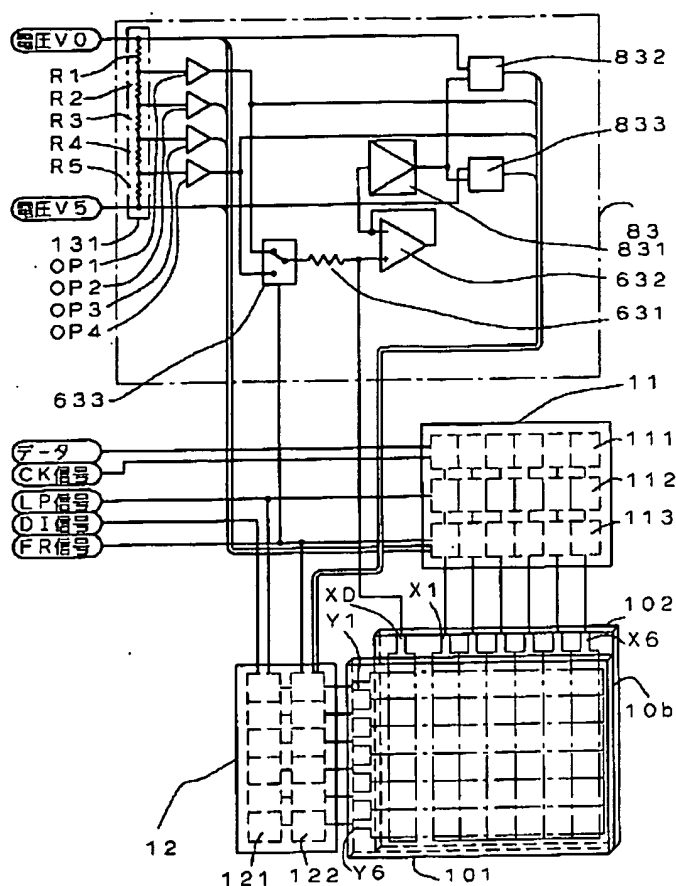
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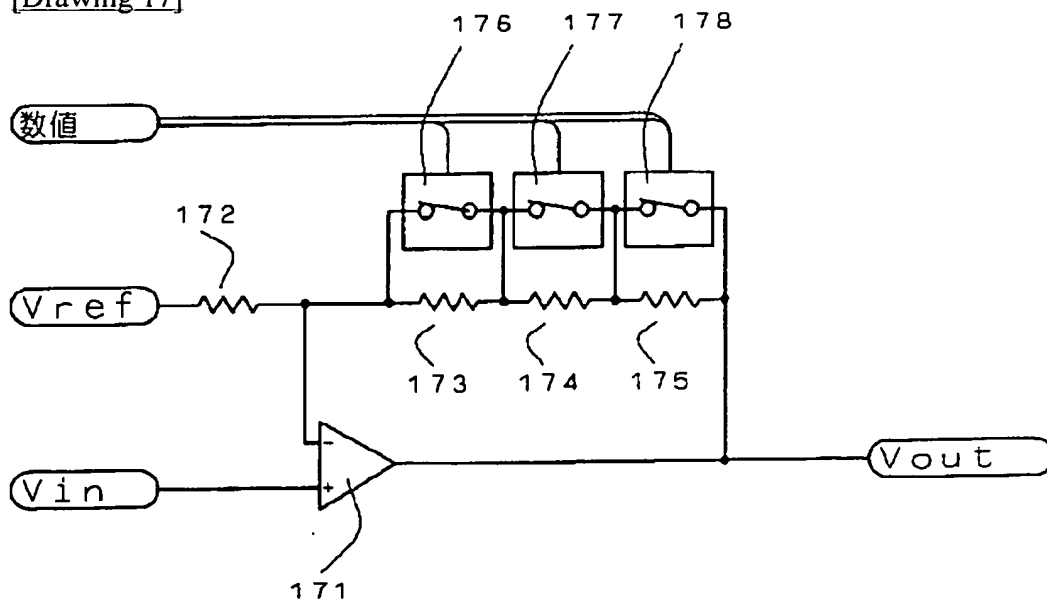
[Drawing 16]



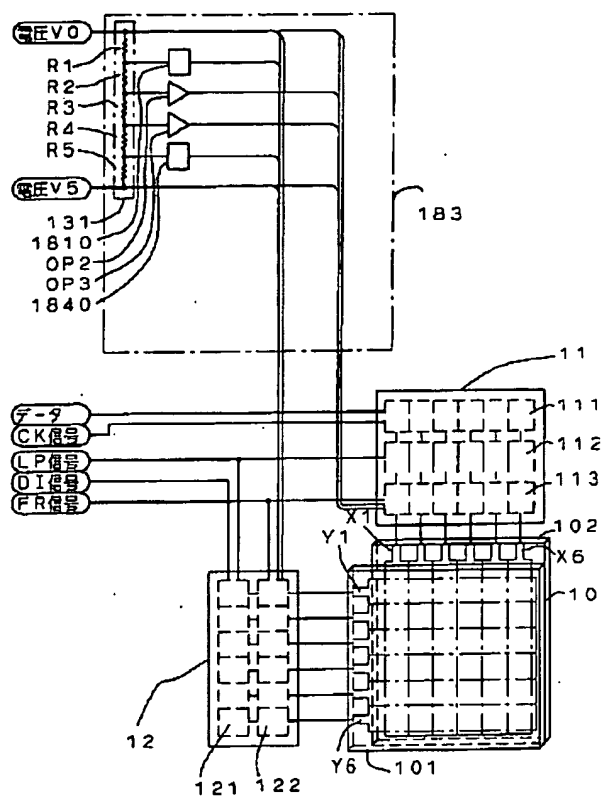
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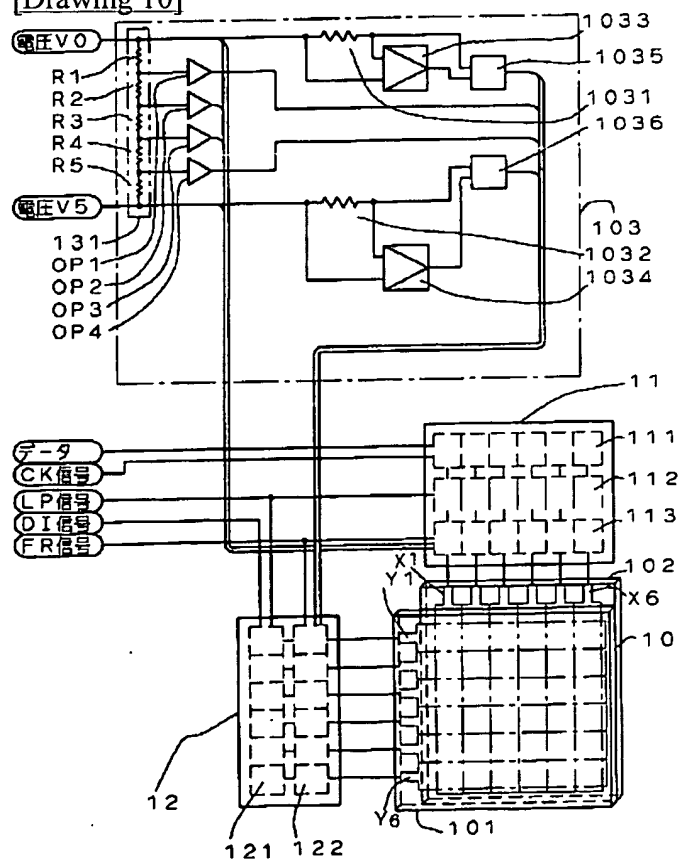
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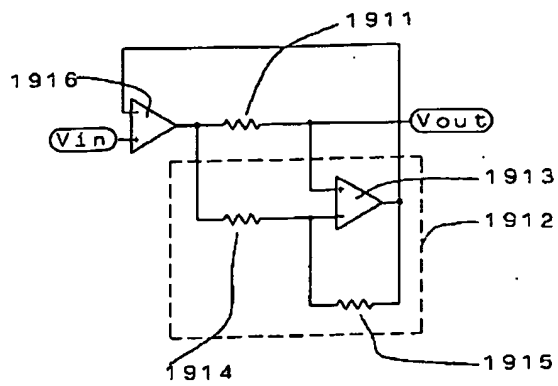
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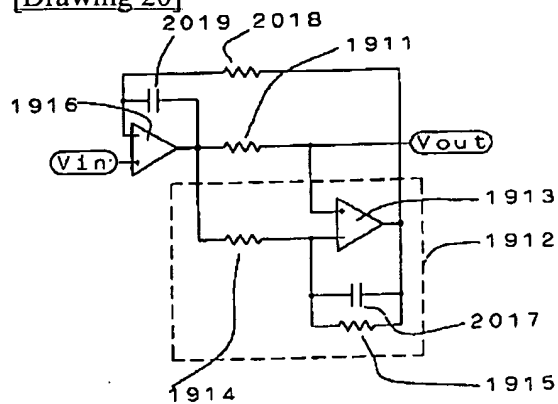
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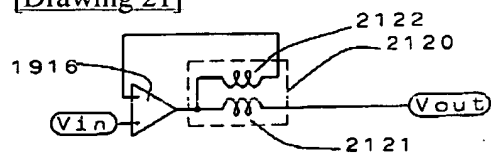
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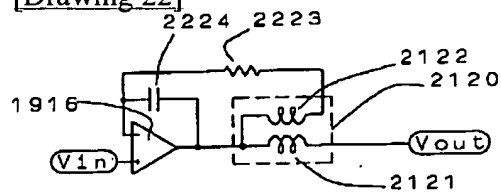
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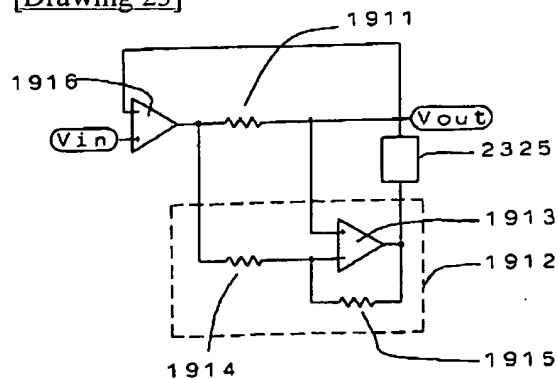
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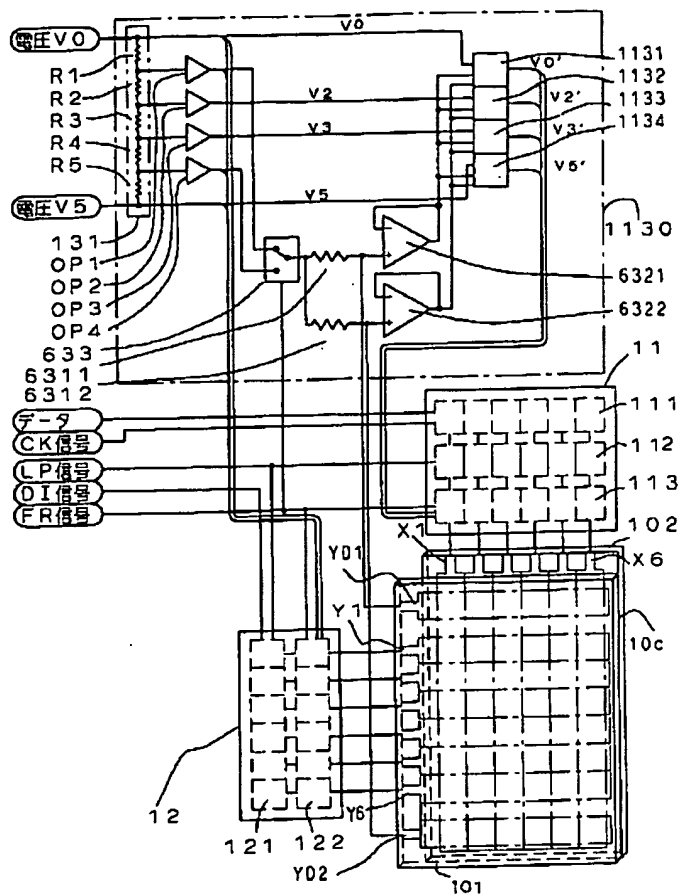
[Drawing 22]



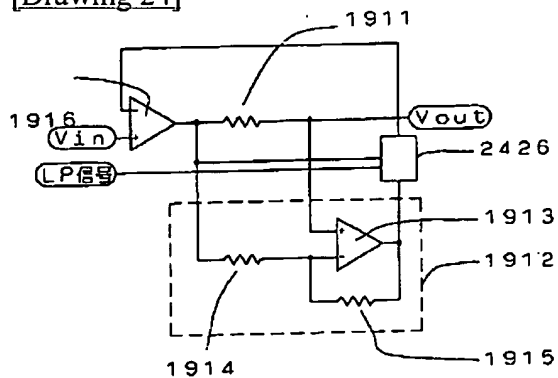
[Drawing 23]



[Drawing 11]



[Drawing 24]



[Translation done.]

* NOTICES *

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CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
 [Section partition] The 2nd partition of the 6th section
 [Publication date] April 27, Heisei 13 (2001. 4.27)

[Publication No.] JP,6-27899,A
 [Date of Publication] February 4, Heisei 6 (1994. 2.4)
 [Annual volume number] Open patent official report 6-279
 [Application number] Japanese Patent Application No. 4-307323
 [The 7th edition of International Patent Classification]

G09G 3/36

[FI]

G09G 3/36

[Procedure revision]
 [Filing Date] September 16, Heisei 11 (1999. 9.16)
 [Procedure amendment 1]
 [Document to be Amended] Specification
 [Item(s) to be Amended] The name of invention
 [Method of Amendment] Modification
 [Proposed Amendment]
 [Title of the Invention] It is the drive approach of liquid crystal equipment to liquid crystal equipment and an electronic equipment list.
 [Procedure amendment 2]
 [Document to be Amended] Specification
 [Item(s) to be Amended] Claim
 [Method of Amendment] Modification
 [Proposed Amendment]
 [Claim(s)]
 [Claim 1] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,
 Liquid crystal equipment characterized by providing a detection means to detect change of the difference of the driver voltage supplied to said scan electrode, and the electrical potential difference

supplied to said scan electrode drive circuit, and an amendment means to supply the correction voltage according to change of said difference which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Claim 2] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,

It comes to provide the electrical-potential-difference detection electrode arranged so that said signal electrode or said scan signal electrode may be intersected,

Liquid crystal equipment characterized by providing a detection means to detect the voltage variation generated in said electrical-potential-difference detection electrode, and an amendment means to supply the correction voltage according to said voltage variation which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Claim 3] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,

Liquid crystal equipment characterized by providing a detection means to detect change of the current which flows from said scan electrode drive circuit to said said power circuit, and an amendment means to supply the correction voltage according to change of said current which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Claim 4] In the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,

Liquid crystal equipment characterized by providing an amendment means to generate said electrical potential difference which a detection means to detect the electrical potential difference of a part with said liquid crystal equipment or change of a current, and said detection means detected, or the correction voltage according to change of a current.

[Claim 5] Electronic equipment characterized by using the liquid crystal equipment of a publication for either among claim 1 thru/or claim 4.

[Claim 6] In the approach of driving the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to the scan electrode drive circuit which supplies driver voltage to the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, and said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, said scan electrode drive circuit, and said signal-electrode drive circuit,

The electrical potential difference of a part with said liquid crystal equipment or change of a current is detected,

The correction voltage according to said change of said detected electrical potential difference or a current is generated,

The drive approach of the liquid crystal equipment characterized by supplying said correction voltage to said scan electrode drive circuit or a signal-electrode drive circuit.

[Procedure amendment 3]

[Document to be Amended] Specification

[Item(s) to be Amended] 0007

[Method of Amendment] Modification

[Proposed Amendment]

[0007]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the liquid crystal equipment of this invention The liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. A detection means to detect change of the difference of the driver voltage supplied to said scan electrode, and the electrical potential difference supplied to said scan electrode drive circuit, And it is characterized by providing an amendment means to supply the correction voltage according to change of said difference which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Procedure amendment 4]

[Document to be Amended] Specification

[Item(s) to be Amended] 0008

[Method of Amendment] Modification

[Proposed Amendment]

[0008] Moreover, the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. It comes to provide the electrical-potential-difference detection electrode arranged so that said signal electrode or said scan signal electrode may be intersected. It is characterized by providing a detection means to detect the voltage variation generated in said electrical-potential-difference detection electrode, and an amendment means to supply the correction voltage according to said voltage variation which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Procedure amendment 5]

[Document to be Amended] Specification

[Item(s) to be Amended] 0009

[Method of Amendment] Modification

[Proposed Amendment]

[0009] Moreover, the liquid crystal panel arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, and the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. It is characterized by providing a detection means to detect the current which flows from said scan electrode drive circuit to said said power circuit, and an amendment means to supply the electrical potential difference according to change of the current which said detection means detected to said scan electrode drive circuit or a signal-electrode drive circuit.

[Procedure amendment 6]

[Document to be Amended] Specification

[Item(s) to be Amended] 0010

[Method of Amendment] Modification

[Proposed Amendment]

[0010] Moreover, the liquid crystal panel arranged so that two or more scan electrodes and two or more

signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. It is characterized by providing an amendment means to generate said electrical potential difference which a detection means to detect the electrical potential difference of a part with said liquid crystal equipment or change of a current, and said detection means detected, or the correction voltage according to change of a current.

[Procedure amendment 7]

[Document to be Amended] Specification

[Item(s) to be Amended] 0011

[Method of Amendment] Modification

[Proposed Amendment]

[0011] Moreover, the electronic equipment of this invention is characterized by using the liquid crystal equipment of above-mentioned this invention.

[Procedure amendment 8]

[Document to be Amended] Specification

[Item(s) to be Amended] 0012

[Method of Amendment] Modification

[Proposed Amendment]

[0012] Moreover, the liquid crystal panel with which the drive approach of the liquid crystal equipment of this invention has been arranged so that two or more scan electrodes and two or more signal electrodes may cross on both sides of a liquid crystal layer, The scan electrode drive circuit which supplies driver voltage to said scan electrode, the signal-electrode drive circuit which supplies driver voltage to said signal electrode, And it sets to the approach of driving the liquid crystal equipment which has the power circuit which generates the electrical potential difference supplied to said scan electrode drive circuit and said signal-electrode drive circuit. The electrical potential difference of a part with said liquid crystal equipment or change of a current is detected, the correction voltage according to said change of said detected electrical potential difference or a current is generated, and it is characterized by supplying said correction voltage to said scan electrode drive circuit or a signal-electrode drive circuit.

[Translation done.]

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【特許請求の範囲】

【請求項1】液晶層を挟持する一対の基板の一方の基板に複数の走査電極が形成され他方の基板に複数の信号電極が前記走査電極と交差するように形成され該交差部分が表示ドットとなる液晶パネルと、該液晶パネルの前記複数の各走査電極に駆動電圧波形を供給する走査電極駆動回路と、前記複数の各信号電極に駆動電圧波形を供給する信号電極駆動回路と、前記走査電極駆動回路が前記複数の各走査電極に供給する駆動電圧波形を形成するのに必要な複数の電圧と前記信号電極駆動回路が前記複数の各信号電極に供給する駆動電圧波形を形成するのに必要な複数の電圧を発生する電源回路と、前記液晶パネルが表示する文字や図形に応じた補正電圧を前記走査電極に印加する前記駆動電圧波形と前記信号電極に印加する前記駆動電圧波形の少なくとも一方に付け加える補正手段を具備する液晶表示装置に於いて、前記補正手段が前記液晶パネルもしくは前記走査電極駆動回路もしくは前記信号電極駆動回路もしくは電源回路の少なくとも一部で発生する電圧、あるいは電流の変化を検出する検出手段を具備し、該検出手段が検出する前記電圧、あるいは電流の変化に応じた大きさの電圧を前記補正電圧とすることを特徴とする液晶表示装置。

【請求項2】請求項1記載の液晶表示装置に於いて、前記検出手段が前記液晶パネルの前記複数の各走査電極の内少なくとも1つ走査電極の駆動電圧波形と前記電源回路が発生する前記走査電極駆動回路が前記複数の各走査電極に供給する駆動電圧波形を形成するのに必要な電圧の内少なくとも1つの電圧との差の電圧変化を検出することを特徴とする液晶表示装置。

【請求項3】請求項1記載の液晶表示装置に於いて、前記液晶パネルの前記走査電極が形成されている基板に少なくとも1つ以上の電圧検出電極を複数の前記信号電極の少なくとも一部と交差するように形成し、または前記液晶パネルの前記信号電極が形成されている基板に少なくとも1つ以上の電圧検出電極を複数の前記走査電極の少なくとも一部と交差するように形成し、前記検出手段が前記電圧検出電極に発生する電圧変動を検出することを特徴とする液晶表示装置。

【請求項4】請求項1記載の液晶表示装置に於いて、前記検出手段が、前記電源回路が前記走査電極駆動回路に供給する少なくとも1つの電圧について前記電源回路から前記走査電極駆動回路に流れる電流を検出することを特徴とする液晶表示装置。

【請求項5】請求項2もしくは3もしくは4記載の液晶表示装置に於いて、前記検出手段が検出する電圧あるいは電流の変化が複数の場合に、前記補正手段が前記検出手段が検出する複数の前記電圧あるいは電流の変化を複数の変数とする所定の関数を設定し該関数に応じた補正電圧を発生することを特徴とする液晶表示装置。

【請求項6】請求項5記載の液晶表示装置に於いて、前

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記関数が前記複数の変数を平均化する関数であることを特徴とする液晶表示装置。

【請求項7】請求項3記載の液晶表示装置に於いて、前記液晶パネルに形成した前記電圧検出電極が複数の場合に、前記補正手段が前記検出手段がそれぞれの前記電圧検出電極から検出する電圧の変化を複数の変数とする所定の関数を設定し該関数に応じた複数の補正電圧を発生することと、前記信号電極あるいは前記走査電極の前記駆動波形に付け加える補正電圧を前記信号電極あるいは前記走査電極の前記液晶パネル内での位置する場所に応じて前記複数の補正電圧のいずれかとすることを特徴とする液晶表示装置。

【請求項8】請求項3記載の液晶表示装置に於いて、前記電圧検出電極が該電圧検出電極と複数の前記信号電極あるいは前記走査電極が各々交差する部分の面積を前記信号電極あるいは前記走査電極によって異ならせてあることを特徴とする液晶表示装置。

【請求項9】請求項5記載の液晶表示装置に於いて、前記補正手段が前記検出手段が検出する複数の前記電圧あるいは電流の変化を複数の変数とする所定の複数の関数を設定し該複数の関数に応じた複数の補正電圧を発生することと、前記信号電極あるいは前記走査電極の前記駆動波形に付け加える補正電圧を前記信号電極あるいは前記走査電極の前記液晶パネル内での位置する場所に応じて前記複数の補正電圧のいずれかとすることを特徴とする液晶表示装置。

【請求項10】請求項3記載の液晶表示装置に於いて、前記補正手段が前記検出手段が検出する電圧変化と前記液晶パネルの前記表示ドットの内点灯しているドット数に応じた補正電圧を発生することを特徴とする液晶表示装置。

【請求項11】請求項1もしくは2もしくは3もしくは4もしくは5もしくは6もしくは7もしくは8もしくは9もしくは10記載の液晶表示装置を具備することを特徴とする電子機器。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は液晶表示装置に関するもので、詳しくは表示むらの改善に関するものである。

【0002】

【従来の技術】液晶表示装置の液晶パネルは、液晶パネルを構成する走査電極及び信号電極に液晶表示装置内の電源回路で発生する異なった電圧で構成された電圧波形（以後、駆動電圧波形と言う。）を供給することで駆動、表示が行われる。そして、液晶パネルが表示する内容に応じてこれらの駆動電圧波形は変化する。

【0003】ここで、液晶パネルが容量性の負荷であり走査電極及び信号電極が電気抵抗を持っていることから走査電極及び信号電極に印加する電圧波形によって、走査電極及び信号電極に印加する電圧波形に至が生じ、こ

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れによって表示にむらが発生すると言った問題があった。

【0004】この問題について、筆者等が出願した特開平2-89号公報等で提示したような駆動電圧波形に補正電圧を付け加えて歪を矯正する方法が知られていた。

【0005】

【発明が解決しようとする課題】しかし、特開平2-89号公報等で提示した方法は表示むらを著しく低減できるが、これを行う際に予め補正量を計算するための回路を必要としていたため、液晶表示装置が複雑なものになり小型軽量化が難しくなっていた。

【0006】本発明はかかる問題を鑑みてなされたものであり、走査電極及び信号電極に印加する電圧波形に生じる歪は走査電極上の電圧に対する信号電極上の電圧の変化の総和で規定されることに着目し、さらにこの電圧の変化の総和に応じた電流が電源回路に流れることから、これらの電圧の変化または電流の変化を監視することによって液晶パネル内での走査電極または信号電極に発生する歪を推定して、この歪を相殺する補正電圧を駆動電圧波形に付け加えることによって、表示むらを解消しようとするもので、その目的は表示むらを簡素な回路構成によって解消し表示品位の高い表示装置及び見やすい表示装置を搭載した小型軽量化した電子機器を提供することにある。

【0007】

【課題を解決する為の手段】第1の本発明の液晶表示装置は、液晶層を挟持する一対の基板の一方の基板に複数の走査電極が形成され他方の基板に複数の信号電極が前記走査電極と交差するように形成され該交差部分が表示ドットとなる液晶パネルと、該液晶パネルの前記複数の各走査電極に駆動電圧波形を供給する走査電極駆動回路と、前記複数の各信号電極に駆動電圧波形を供給する信号電極駆動回路と、前記走査電極駆動回路が前記複数の各走査電極に供給する駆動電圧波形を形成するのに必要な複数の電圧と前記信号電極駆動回路が前記複数の各信号電極に供給する駆動電圧波形を形成するのに必要な複数の電圧を発生する電源回路と、前記液晶パネルが表示する文字や図形に応じた補正電圧を前記走査電極に印加する前記駆動電圧波形と前記信号電極に印加する前記駆動電圧波形の少なくとも一方に付け加える補正手段を具備する液晶表示装置に於いて、前記補正手段が前記液晶パネルもしくは前記走査電極駆動回路もしくは前記信号電極駆動回路もしくは電源回路の少なくとも一部で発生する電圧、あるいは電流の変化を検出する検出手段を具備し、該検出手段が検出する前記電圧、あるいは電流の変化に応じた大きさの電圧を前記補正電圧とすることを特徴する。

【0008】第2の本発明の液晶表示装置は、第1の本発明の液晶表示装置に於いて、前記検出手段が前記液晶パネルの前記複数の各走査電極の内少なくとも1つ走査

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電極の駆動電圧波形と前記電源回路が発生する前記走査電極駆動回路が前記複数の各走査電極に供給する駆動電圧波形を形成するのに必要な電圧の内少なくとも1つの電圧との差の電圧変化を検出することを特徴とする。

【0009】第3の本発明の液晶表示装置は、第1の本発明の液晶表示装置に於いて、前記液晶パネルの前記走査電極が形成されている基板に少なくとも1つ以上の電圧検出電極を複数の前記信号電極の少なくとも一部と交差するように形成し、または前記液晶パネルの前記信号電極が形成されている基板に少なくとも1つ以上の電圧検出電極を複数の前記走査電極の少なくとも一部と交差するように形成し、前記検出手段が前記電圧検出電極に発生する電圧変動を検出することを特徴とする。

【0010】第4の本発明の液晶表示装置は、第1の本発明の液晶表示装置に於いて、前記検出手段が、前記電源回路が前記走査電極駆動回路に供給する少なくとも1つの電圧について前記電源回路から前記走査電極駆動回路に流れる電流を検出することを特徴とする。

【0011】第5の本発明の液晶表示装置は、第2もしくは3もしくは4の本発明の液晶表示装置に於いて、前記検出手段が検出する電圧あるいは電流の変化が複数の場合に、前記補正手段が前記検出手段が検出する複数の前記電圧あるいは電流の変化を複数の変数とする所定の関数を設定し該関数に応じた補正電圧を発生することを特徴とする。

【0012】第6の本発明の液晶表示装置は、第5の本発明の液晶表示装置に於いて、前記関数が前記複数の変数を平均化する関数であることを特徴とする。

【0013】第7の本発明の液晶表示装置は、第3の本発明の液晶表示装置に於いて、前記液晶パネルに形成した前記電圧検出電極が複数の場合に、前記補正手段が前記検出手段がそれぞれの前記電圧検出電極から検出する電圧の変化を複数の変数とする所定の関数を設定し該関数に応じた複数の補正電圧を発生することと、前記信号電極あるいは前記走査電極の前記駆動波形に付け加える補正電圧を前記信号電極あるいは前記走査電極の前記液晶パネル内での位置する場所に応じて前記複数の補正電圧のいずれかとすることを特徴とする。

【0014】第8の本発明の液晶表示装置は、第3の本発明の液晶表示装置に於いて、前記電圧検出電極が該電圧検出電極と複数の前記信号電極あるいは前記走査電極が各々交差する部分の面積を前記信号電極あるいは前記走査電極によって異ならせてあることを特徴とする。

【0015】第9の本発明の液晶表示装置は、第5の本発明の液晶表示装置に於いて、前記補正手段が前記検出手段が検出する複数の前記電圧あるいは電流の変化を複数の変数とする所定の複数の関数を設定し該複数の関数に応じた複数の補正電圧を発生することと、前記信号電極あるいは前記走査電極の前記駆動波形に付け加える補正電圧を前記信号電極あるいは前記走査電極の前記液晶

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パネル内での位置する場所に応じて前記複数の補正電圧のいずれかとすることを特徴とする。

【0016】第10の本発明の液晶表示装置は、第3の本発明の液晶表示装置に於いて、前記補正手段が前記検出手段が検出する電圧変化と前記液晶パネルの前記表示ドットの内の点灯しているドット数に応じた補正電圧を発生することを特徴とする。

【0017】第11の本発明の電子機器は、第1もしくは2もしくは3もしくは4もしくは5もしくは6もしくは7もしくは8もしくは9もしくは10の本発明の液晶表示装置を具備することを特徴とする。

【0018】

【実施例】

【実施例1】本発明の駆動方法を実施例を用いてさらに詳しく説明する。ここで、まず液晶パネルの信号電極の配列方向に発生する表示むらを解消する場合について説明する。

【0019】図1は本実施例の構成を示す図である。図で、10は液晶パネルで液晶層（図示せず。）を挟持する一対の基板101、102からなり一方の基板101には走査電極Y1～Y6、他方の基板102には信号電極X1～X6が形成されている。ここで、走査電極Y1～Y6、信号電極X1～X6はそれぞれ6本と少ないがこれは説明を簡単にするためで、通常これよりはるかに多い。

【0020】11はXドライバであり、111～113はその内部構成要素でそれぞれ6ビットのシフト・レジスタ回路、6ビットのラッチ回路、6ビットの4回路1接点のアナログ・スイッチ回路である。なお、ビット数は液晶パネル10の信号電極の数である。

【0021】12はYドライバであり、121、122はその内部構成要素でそれぞれ6ビットのシフト・レジスタ回路、6ビットの4回路1接点のアナログ・スイッチ回路である。なお、ビット数は液晶パネル10の走査電極の数である。そして、データ信号、CK信号、LP信号、DI信号、FR信号が外部より取り込まれる。以上の構成は従来技術の構成と同じである。

【0022】13は電源回路で、液晶パネルを駆動するのに必要な6レベルの電圧を、電圧V0－電圧V1＝電圧V1－電圧V2＝電圧V3－電圧V4＝電圧V4－電圧V5（＝Vとおく。）で、電圧V0－電圧V5＝n・V（nは正数で、通常10前後。）となる関係を持つ電圧V0～V5を発生させる場合に、131は電圧分割回路で、5本の抵抗器R1、R2、R3、R4、R5からなり、抵抗器R1、R2、R4、R5はRなる抵抗値を持ち、R3は（n－4）Rなる抵抗値を持つ。この電圧分割回路131の両端に、即ち図で抵抗器R1の上と抵抗器R5の下にそれぞれ電圧V0、電圧V5を印加すると各抵抗器R1とR2、R2とR3、R3とR4、R4とR5間にそれぞれ電圧V1、V2、V3、V4が分割

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されて発生する。

【0023】OP1～OP4は電圧分割回路11が発生した電圧V1、V2、V3、V4をインピーダンスを下げて出力するボルテージ・ホロワ回路である。このボルテージ・ホロワ回路OP1～OP4は、一般的には演算増幅回路によって構成されている。

【0024】132は基準電圧切り替えスイッチで、FR信号に応じて電圧V1と電圧V4のいずれかを切り替えて出力するスイッチである。

10 【0025】133は入力電圧切り替え制御回路で、Yドライバが走査電極Y1からY3のいずれかに選択電圧を出力している間に”0”を、走査電極Y4からY6のいずれかに選択電圧を出力している間に”1”となるスイッチ制御信号134を出力する回路である。この回路はLP信号をクロック信号、DI信号をリセット信号とした計数回路とこの計数回路の結果の大きさを比較する比較回路等で容易に形成することが出来るので、特に図示して説明することは省略する。

20 【0026】135は入力電圧切り替えスイッチで、スイッチ制御信号134が”1”の時にYドライバ12が走査電極Y2に出力する電圧を、”0”の時にY5に出力する電圧波形を選択して出力する。

【0027】136は差動増幅回路で、基準電圧切り替えスイッチ21と入力電圧切り替えスイッチから出力された電圧の差を出力する。

30 【0028】137～140は電圧加算回路で、それぞれ外部から供給される電圧及びボルテージ・ホロワ回路OP2、OP3が出力する電圧V0、V2、V3、V5に差動増幅回路136が出力する電圧を加算した電圧をそれぞれ電圧V0'、V2'、V3'、V5'として出力する。ここで電圧加算回路137～140の具体的な構成例を図2に示す。図で端子Vrefは基準電圧を入力する端子で図1の電圧V0、V2、V3、V5のいずれかが入力する。図2で端子Vinは差動増幅回路136の出力する電圧を入力する。201は抵抗器、202はコンデンサで微分回路を形成し、203は演算増幅回路によるボルテージ・ホロワ回路である。端子Voutはボルテージ・ホロワ回路203の出力で図1の電圧V0'、V2'、V3'、V5'と対応する。ここで、図2で端子Vinに入力する差動増幅回路136の出力する電圧はほぼ微分波形に近いのでこの電圧を抵抗201とコンデンサ202からなる微分回路の端子Vinに接続することによって、近似的に端子Vrefの電圧に端子Vinの電圧を加えた電圧をボルテージ・ホロワ回路203から出力することが出来る。

50 【0029】そして、図1で電圧V0、V1、V4、V5はYドライバ12に供給され、電圧V0'、V2'、V3'、V5'はXドライバ11に供給される。ここで、Yドライバ12に供給する電圧V5、V1及びXドライバ11に供給する電圧V0'、V2'をそれぞれ第

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1の電圧群の選択電圧、非選択電圧、点灯電圧、非点灯電圧と呼び、電圧V0、V4、V5'、V3'をそれぞれ第2の電圧群の選択電圧、非選択電圧、点灯電圧、非点灯電圧と呼ぶ。

【0030】以上の構成となっている。なお、各回路間の接続については図により明確なので説明を省略する。そして図3に示すように、データ信号、CK信号、LP信号、DI信号が外部から供給される。

【0031】ここで、動作を説明する。

【0032】まず、Xドライバ11は図3に示すCK信号に同期して表示内容を決めるデータ信号をシフト・レジスタ回路111に順次取り込み、シフトする。そして、シフト・レジスタ回路111に液晶パネル10の信号電極数と同じ数だけデータを取り込むと、図3に示すLP信号に同期してシフト・レジスタ回路111の各ビットの内容がラッチ回路112の各ビットに取り込まれる。レベル・シフタ回路113はラッチ回路112に取り込んだ内容とFR信号15に応じた電圧を出力する。即ち、ラッチ回路112に取り込んだ各ビットの内容が点灯を示す(以後、"1"とする。)場合には点灯電圧を出力し、内容が非点灯を示す(以後、"0"とする。)場合には非点灯電圧を出力する。そして、FR信号が第1の電圧群を選択することを示す(以後、"0"とする。)場合については第1の電圧群を出力し、FR信号が第2の電圧群を選択することを示す(以後、"1"とする。)場合については第2の電圧群を出力する。

【0033】Yドライバ12はLP信号に同期して選択する走査電極を決める図4に示すDI信号をシフト・レジスタ回路121に順次取り込み、シフトする。レベル・シフタ回路122はラッチ回路121に取り込んだ内容とFRI信号15に応じた電圧を出力する。即ち、ラッチ回路112に取り込んだ各ビットの内容が選択を示す場合には選択電圧を出力し、内容が非選択を示す場合には非選択電圧を出力する。そして、FR信号15が"0"の場合については第1の電圧群を出力し、FR信号が"1"の場合については第2の電圧群を出力する。

【0034】ここで、入力電圧切り替え制御回路133は入力電圧切り替えスイッチを、選択電圧が走査電極Y1からY3に印加する期間では、Yドライバ12が走査電極Y5に出力する電圧を差動増幅回路136に出力し、選択電圧が走査電極Y4からY6に印加する期間では、Yドライバ12が走査電極Y2に出力する電圧を差動増幅回路136に出力する。よって、常にFR信号に応じて電圧V1とV4が切り替わる電圧波形に歪が重畳された電圧を136に出力する。

【0035】この時、132は基準電圧切り替えスイッチはFR信号に応じて電圧V1とV4のいずれかを差動増幅回路136に出力する。

【0036】従って、差動増幅回路136はYドライバ

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12が走査電極Y2もしくはY5に出力する電圧波形の歪分のみが出力される。

【0037】この歪分を電圧加算回路137~140で、電圧V0、V2、V3、V4に加算して電圧V0'、V2'、V3'、V4'としてXドライバ11に出力する。

【0038】以上の動作を行う。

【0039】従って、非選択電圧(V1またはV4)の印加する走査電極上の電圧に歪(これをVeとする。)が発生すると、走査電極上の電圧はVc+Veとなる。この時、信号電極上の電圧は電圧V0、V1またはV3、V5にVeを加えた電圧V0'、V2'またはV3'、V5'になる。従って、走査電極と信号電極の電圧差は、 $V0' - V1 = (V0 + Ve) - (V1 + Ve) = V$

$$V1 - V2' = (V1 + Ve) - (V2 + Ve) = V$$

$$V3' - V4 = (V3 + Ve) - (V4 + Ve) = V$$

$$V4 - V5' = (V4 + Ve) - (V5 + Ve) = V$$

となって、歪の大きさ向きの如何にかかわらず常に差は一定となる。よって、液晶パネル10の各ドットに印加する実効電圧に差異が無くなって表示むらが無くなる。これを図4に示す。図4は液晶パネル10がある表示を行った時の電圧V0~電圧V2及び電圧V0'~V2'及び走査電極Y2ないしY5に出力するYドライバ12の出力波形の一部分を示す図である。

【0040】図で破線の401~402は電圧V0~V2を示し、実線の404、406は電圧V0'、V2'を示し、実線の405は走査電極Y2ないしY5に出力するYドライバ12の出力波形を示す。そして、407、408はそれぞれ電圧V0'、V2'とYドライバ12の出力波形405の電圧差を示す。なお、401~403は見やすいように少しずらして表示してある。ここで、Yドライバ12の出力波形405が歪んで、電圧変動が発生するとこれに追従して404と406即ち電圧V0'とV1'も電圧が変動する。これによって、電圧差407、408は歪によらずに常に一定となる。ここでは、第1の電圧群について説明したが、第2の電圧群についても同様となる。

【0041】Yドライバ12の出力する電圧波形の歪分をXドライバ11に供給する電圧に単に付け加えたが、Yドライバ12の出力する電圧波形の歪より液晶パネル10の内部の方がより大きく歪むのでこの分を考慮してXドライバ11に供給する電圧に付け加える電圧を大きめにしても良い。これは差動増幅回路136の利得を適当な値に設定することによって容易に設定出来る。そして、この場合には検出した歪に対して必ずしも線形に大きくする必要はない。

【0042】なお参照する走査電極をここではY2とY5としたが、勿論これに限定するものはなく、いずれの場所の走査電極についてでも良い。また、複数の走査電

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極についての歪を平均化して用いても良い。

【0043】以上述べたように走査電極上の電圧変動を検出して信号電極上の電圧もこれに対応して変動させることによって、容易で簡素に表示むらを解消することが出来た。

【0044】〔実施例2〕実施例1では、信号電極の駆動電圧波形に補正電圧を付け加える方法を示したが、走査電極の駆動電圧波形に補正電圧を付け加えることも容易で同様の効果を得られる。この例を説明する。図5は本実施例の構成の一例を示す図である。

【0045】図で、53が電源回路で、電源回路53内の531～533以外は図1と同じもので同じ動作をするので同番号を付して説明を省略する。

【0046】531は差動増幅回路で、基準電圧切り替えスイッチ21と入力電圧切り替えスイッチから出力された電圧の差を極性を反転して出力する。

【0047】532と533は図1の電圧加算回路137～140と同じ回路構成を持つ電圧加算回路で、ボルテージ・ホロワ回路OP1、OP4が出力する電圧V1、V4に差動増幅回路531が出力する電圧を加算した電圧をそれぞれ電圧V1'、V2'として出力する。

【0048】そして、図1で電圧V0、V1'、V4'、V5はYドライバ12に供給され、電圧V0、V2、V3、V5はXドライバ11に供給される。ここで、Yドライバ12に供給する電圧V5、V1'及びXドライバ11に供給する電圧V0、V2がそれぞれ第1の電圧群の選択電圧、非選択電圧、点灯電圧、非点灯電圧となり、電圧V0、V4'、V5、V3がそれぞれ第2の電圧群の選択電圧、非選択電圧、点灯電圧、非点灯電圧となる。

【0049】以上の構成となっているので、非選択電圧(V1またはV4)の印加する走査電極上の電圧に歪(これをV_eとする。)が発生しようとする時、即ち走査電極上の電圧がV_c+V_eとなろうとする時、電圧加算器532、533は-V_eの電圧を電圧V1またはV4に加えるので発生しようとする歪がほぼ相殺される。従って、走査電極上の非選択電圧には歪が殆ど無くなって、表示むらが無くなる。

【0050】Yドライバ12の出力する電圧波形の歪より液晶パネル10の内部の方がより大きく歪むのでこの分を考慮してYドライバ12に供給する電圧に付け加える補正電圧を大きめにしても良い。これは差動増幅回路531の利得を適当な値に設定することによって容易に設定出来る。そして、この場合には検出した歪に対して必ずしも線形に大きくする必要はない。

【0051】以上述べたように走査電極上の電圧変動を検出して、走査電極上の電圧をこれに対応して変動させることでも、表示むらを解消することが出来た。

【0052】また、実施例1と実施例2を組み合わせると信号電極及び走査電極の駆動電圧波形の両方に補正電圧

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を加えても同様の効果がある。

【0053】〔実施例3〕他の実施例を示す。実施例1、2では特定の走査電極に出力するYドライバの出力波形の歪でXドライバあるいはYドライバに供給する電圧を変化させることによって表示むらを解消した。ここで、筆者が出願した特開平2-89号公報で詳しく説明してあるが、簡単に言えば各信号電極の走査電極に対する電圧の変化の総和で、Yドライバの出力波形ないし走査電極上の電圧波形の歪が規定されている。従って、液晶パネルの走査電極が形成されている基板上に電圧検出電極を形成し、この電圧検出電極を信号電極と液晶層によって容量結合させ、信号電極の電圧変化の総和を検出し、この結果より、走査電極上の歪を推定してXドライバに供給する電圧を変化させてもよい。

【0054】これを、図6を用いてさらに詳しく説明する。図6はこの実施例の構成を示す。図で液晶パネル10aと電源回路63以外は図1の構成と同じであり説明を省略する。

【0055】図6で液晶パネル10aは図1の液晶パネル10の基板101上に新たに電圧検出電極YDを付け加えたものである。電圧検出電極YDは図に示すように信号電極X1～X6の全てに対向するように設けてある。ここで、信号電極X1からX6上の電圧変化による走査電極上に発生させる影響が各信号電極毎に異なる場合には、電圧検出電極YDの幅は一樣でなくとも良く、例えば左から右になるに従って広くなるように形成しても良い。

【0056】図6で63は電源回路で、631～633以外の構成要素は図1の電源回路13と同じなので説明を省略する。631は抵抗器で液晶パネル10a上に設けた電圧検出電極YDとこれに対向する信号電極X1～X6からなるコンデンサとで微分回路を形成する。632はボルテージ・ホロワ回路で電圧検出電極YDに発生する電圧をインピーダンスを下げて出力する。このボルテージ・ホロワ回路632は必ずしも1倍の増幅率で無く任意倍の非反転増幅器であっても良い。633はスイッチ回路で抵抗器631の一端に加える電圧(以後、基準電圧と言う)を電圧V1と電圧V4のいずれかに切り替えるスイッチである。即ち、Yドライバが非選択電圧として電圧V1を用いている時には電圧V1を、電圧V4を用いている時は電圧V4を抵抗器631の一端に加える。以上の構成となっているので、ボルテージ・ホロワ回路632は各信号電極X1～6の電圧の変化の総和に応じた電圧変動を発生するから、この電圧変動を用いて電圧加算回路137～140で電圧V0'、V2'、V3'、V5'を発生する。

【0057】以上の構成と動作をする。

【0058】従って、実施例1と同様の動作をするから同様の効果を得るとともに、駆動方法が電圧平均化法でない場合、例えば特開昭60-247224号公報等で

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提示されている2値の電圧で異なった形状の電圧波形が走査電極に印加させて駆動する方法で液晶パネルを駆動した場合に、各走査電極の電圧波形が個々に異なった形状をしている為に、走査電極走査電極の歪を直接検出することが難しいので、電圧検出電極によって走査電極上の歪を推定するこの実施例の方法が有効である。

【0059】なお、スイッチ回路631は、Yドライバ12が用いる非選択電圧が電圧V1とV4の2つの電圧を用いることによって必要となっている。即ち、Yドライバ12の出力する非選択電圧に対する信号電極上の電圧変化の総和を検出する際にYドライバ12が出力する非選択電圧が電圧V1(4)からV4(1)に切り替わる時(FR信号が変化するとき)に抵抗器631の一端に加える基準電圧も変更する必要があるからである。従って、Yドライバを非選択電圧を共通化し、非選択電圧を基準として、選択電圧を絶対値が同じ正負電圧の組(必ずしも1組である必要はない。)で動く構成として、Xドライバも同様に絶対値の同じ正負電圧(必ずしも1組である必要はない)で動く構成にすることによって、電圧V1とV4を切り替える比較的高耐圧のスイッチ回路633は不要となり、また抵抗器631の一端に加える基準電圧の値は任意の一定電圧で良くなる。例えば、基準電圧を電圧V0とV5の中点の電圧に設定しても良い。

【0060】さらに、図6のYドライバ12と同等のFR信号が変化すると非選択電圧が電圧V1(4)からV4(1)に切り替わる構成のYドライバであっても、FR信号が変化する時に補正電圧を強制的に発生させないような回路(例えば、抵抗器631を短絡する低耐圧のスイッチ)構成にすることによっても、スイッチ回路633は不要となり、また抵抗器631の一端に加える基準電圧の値は任意の一定電圧で良くなる。

【0061】また、本実施例では信号電極の駆動電圧波形に補正電圧を付け加えているが、ボルテージ・ホロウ回路632が出力する電圧の極性を反転させる反転増幅回路を設け、この出力電圧を補正電圧として、これを走査電極の駆動電圧波形に付け加えることによって、実施例2と同じ効果が得られる。

【0062】〔実施例4〕また、さらにYドライバの出力波形ないし走査電極上の電圧波形の歪は、Yドライバ及び走査電極に電流が流れることによって発生する。そして、この電流はYドライバを介して電源回路に流入する。従って、この電源回路に流れる電流を検出することによって、歪を推定出来る。これによって、Xドライバに供給する電圧を変化させてもよい。

【0063】これを、図7を用いてさらに詳しく説明する。図7はこの実施例の構成を示す。図で電源回路73以外は図1の構成と同じであり説明を省略する。さらに図6の電源回路73で、抵抗器731、732、差動増幅回路733、734以外の構成要素は図1の電源回路13と同じなので説明を省略する。抵抗器731、73

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2は電流検出抵抗で微小な抵抗値を持ち、この抵抗器に流れる電流に比例した電圧を抵抗器の両端に発生させる。差動増幅回路733、734はそれぞれ抵抗器731、732の両端に発生する電圧差を電圧加算回路に出力する。この電圧差に基づいて電圧加算回路137~140で電圧V0'、V2'、V3'、V5'を発生する。以上の構成と動作をする。

【0064】従って、実施例1と同様の動作をするから同様の効果を得るとともに、実施例1で必要であった基準電圧切り替えスイッチ132、入力電圧切り替え制御回路133、入力電圧切り替えスイッチ135が不要となりより回路を簡素化できる。

【0065】また、差動増幅回路733、734の出力する電圧の極性を反転した電圧を補正電圧として、これを走査電極の駆動電圧波形に付け加えることによって実施例2と同じ効果が得られる。

【0066】なお、本実施例では非選択電圧の電流を検出する方法を示したが、各信号電極が走査電極上の駆動電圧波形(非選択電圧)に発生する歪は各信号電極に印加する電圧が点灯電圧から非点灯電圧、非点灯電圧から点灯電圧に切り替わる時の各信号電極に流れる電流の総和に他ならないから、例えば図7のXドライバ11に供給される点灯電圧、非点灯電圧の電流を微小な値の抵抗器等で各々検出しそれを足し合わせるることによっても走査電極上の駆動電圧波形(非選択電圧)に発生する歪を推定することが出来、これによって補正電圧を作ること容易に出来、同様の効果が得られる。

【0067】〔実施例5〕実施例1~4では液晶パネルの信号電極の配列方向に発生する表示むらを解消した。ここで、次に液晶パネルの走査電極の配列方向に発生する表示むら(以後、この表示むらを横糸引きと言う。)を解消する実施例を示す。この横糸引きは、筆者が出願した特開平2-89号公報で詳しく説明してあるが、簡単に言えば各走査電極上の表示ドットがより多く点灯することによってこの走査電極上の表示ドットが作るコンデンサの容量が大きくなって走査電極の駆動電圧波形が非選択電圧から選択電圧に切り替わる時により多くなまる為にその走査電極上の表示ドットに印加する実効電圧が小さくなって横糸引きが発生する。即ち、選択電圧に切り替わる時の波形のなまり量によって横糸引きが規定される。

【0068】従って、液晶パネルの信号電極が形成されている基板上に電圧検出電極を形成し、この電圧検出電極を信号電極と液晶層によって容量結合させ、走査電極の電圧変化の総和を検出し、この結果より、走査電極上のなまりを推定してYドライバに供給する選択電圧を変化させることによって、この表示むらを解消出来る。

【0069】これを、図8を用いてさらに詳しく説明する。図8はこの実施例の構成を示す。図で液晶パネル10bと電源回路83以外は図1の構成と同じであり説明

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を省略する。

【0070】図8で液晶パネル10bは図1の液晶パネル10の基板102上に新たに電圧検出電極XDを付け加えたものである。電圧検出電極XDは図に示すように走査電極Y1～Y6の全てに対向するように設けてある。

【0071】図8で83は電源回路で、831～833以外の構成要素は図1の電源回路13と同じなので説明を省略する。831は反転増幅回路でボルテージ・ホロワ回路632が出力する電圧を反転する。832、833は加算器で図1の加算器137と同じ回路構成と機能をする。

【0072】以上の構成となっている。ここで、液晶パネル10bが走査電極Y3上の表示ドットが多く点灯し、他の走査電極上の表示ドットが少なく点灯しているような表示を行う場合のボルテージ・ホロワ回路632が出力する電圧と各走査電極上の電圧波形を模式的に図9に示す。図で901はボルテージ・ホロワ回路632が出力する電圧波形、902～904は各々走査電極Y2～Y4上の電圧波形を示す。なお、902～904は仮りに走査電極の駆動波形に補正電圧を付け加えないとした場合の電圧波形である。ここで、電圧波形901は全ての走査電極Y1～6の電圧波形の変化の総和となり、図では走査電極Y2～4に順次選択電圧が切り替わって印加する部分を示している。

【0073】図9で示すように、走査電極Y2からY3に選択電圧が印加する走査電極が切り替わる時は走査電極Y3上の電圧波形903は大きくなまって選択電圧になるので、ボルテージ・ホロワ回路632が出力する電圧901もこれとほぼ同じ大きさの大きな微分波形を発生する。そして、走査電極Y3からY4に選択電圧が印加する走査電極が切り替わる時は走査電極Y4上の電圧波形904は殆どなまらずに選択電圧になるので、ボルテージ・ホロワ回路632が出力する電圧901も小さな微分波形を発生する。

【0074】ここで、ボルテージ・ホロワ回路632の出力は反転増幅回路831で極性反転されて、これを補正電圧として加算器832、833で選択電圧に付け加える。

【0075】従って、走査電極Y3上の電圧波形903は大きくなまって選択電圧になろうとする時は、より大きな補正電圧が付け加えられた選択電圧が印加するので、実際にはより早く選択電圧に達するように矯正される。

【0076】よって、各走査電極上の表示ドットの点灯している数によらずにほぼ非選択電圧から選択電圧に切り替わる時のなまり方はほぼ同じになって、横糸引きを防止することが出来る。

【0077】【実施例6】さらに、Yドライバの出力波形ないし走査電極上の電圧波形の歪は、Yドライバ及び

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走査電極に電流が流れることによって発生するから、ある走査電極に選択電圧が印加する時にこの走査電極上の表示ドットが多く点灯している場合に多い場合に電圧波形は大きくなまるが、これはより多くの電流がこの走査電極に流れているのに他ならない。従って、この走査電極に流れる電流、言い替えれば電源回路の選択電圧を発生する部分に流れる電流を検出することによって、歪を推定出来る。これによって、Yドライバに供給する電圧を変化させてもよい。

10 【0078】これを、図10を用いてさらに詳しく説明する。図10はこの実施例の構成を示す。図で電源回路103以外は図7の構成と同じであり説明を省略する。さらに図10の電源回路103で、抵抗器1031、1032、差動増幅回路1033、1034、加算器1035、1036以外の構成要素は図7の電源回路73と同じなので説明を省略する。抵抗器1031、1032は電流検出抵抗で微小な抵抗値を持ち、この抵抗器に流れる電流に比例した電圧を抵抗器の両端に発生させる。差動増幅回路1033、1034はそれぞれ抵抗器1031、1032の両端に発生する電圧差を任意倍した電圧をそれぞれ電圧加算回路に出力する。これらの電圧差を電圧加算回路1035、1036は電圧V0、V5にそれぞれ加算して電圧V0'、V5'を発生する。以上の構成と動作をする。

20 【0079】従って、ある走査電極に選択電圧が印加する時にこの走査電極上の電圧波形が大きくなろうとする時に、抵抗器1031、1032には大きな電流が流れるので、電圧V0'、V5'は非選択電圧に対して電圧V0、V5より大きな絶対値の電圧となる。従って、この走査電極上の電圧波形の大きななまりが解消される。これによって、実施例5と同様の効果が得られる。

30 【0080】【実施例7】実施例3では液晶パネルの走査電極が形成されている基板上に電圧検出電極を1本形成し、この電圧検出電極を信号電極と液晶層によって容量結合させ、信号電極の電圧変化の総和を検出し、この結果より、走査電極上の歪を推定してXドライバに供給する電圧を変化させていた。しかし、走査電極数が多くなると、言い替えれば各信号電極の長さが長くなると、各信号電極のXドライバに近い部分と遠い部分とで電圧変化の度合いが異なってしまう、正確に走査電極上の歪を推定するのが難しい場合がある。このような場合には電圧検出電極を複数本形成しこれらの電圧検出電極が検出する電圧を各々適宜重み付けして、言い替えればこれらの電圧を変数とするある適当な関数とした補正電圧を発生させてこれによって信号電圧の駆動波形にこの補正電圧を付け加えれば良い。

40 【0081】これを、図11を用いてさらに詳しく説明する。図11はこの実施例の構成を示す。図で液晶パネル10cと電源回路113以外は図1の構成と同じであり説明を省略する。

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【0082】図11で液晶パネル10cは図1の液晶パネル10の基板101上に新たに電圧検出電極YD1、2をそれぞれ図に示すように信号電極X1～X6の全てに対向するように上下の両辺部に設けてある。ここで、信号電極X1からX6上の電圧変化による走査電極上に発生させる影響が各信号電極毎に異なる場合には、電圧検出電極YDの幅は一樣でなくとも良く、例えば左から右になるに従って広くなるように形成しても良い。

【0083】図11で1130は電源回路で、6311、6312、6321、6322と1131～1134以外の構成要素は図1の電源回路13と同じなので説明を省略する。6311と6312は抵抗器でそれぞれ電圧検出電極YD1、2がこれに対向する信号電極X1～X6からなるコンデンサとで微分回路を形成する。6321、6322はボルテージ・ホロワ回路で電圧検出電極YD1、2に発生する電圧をそれぞれインピーダンスを下げて出力する。なお、この回路は必ずしも1倍の増幅率でなく任意の倍率の非反転増幅器であっても構わない。1131～1134は加算器で電圧V0、V2、V3、V5に2つのボルテージ・ホロワ回路6321、2が出力する電圧を加算して、それぞれ電圧V0'、V2'、V3'、V5'を発生する。

【0084】以上の構成と動作をする。ここで、加算器1131～1134の一構成例を図12に示す。図で、1201は抵抗器、1202、1203はコンデンサで2入力の微分回路を形成し、1204は演算増幅回路によるボルテージ・ホロワ回路である。また端子Vin1、2はそれぞれ図11のボルテージ・ホロワ回路6321、2の出力する電圧を入力し、端子Vrefは電圧V0、V2、V3、V5のいずれかの電圧を入力する。図12の端子Voutはボルテージ・ホロワ回路203の出力で図11の電圧V0'、V2'、V3'、V5'に対応する。ここで、図12で端子Vinに入力するボルテージ・ホロワ回路6321、2の出力する電圧はほぼ微分波形に近いのでこれらの電圧を抵抗1201とコンデンサ1202、1203からなる微分回路の端子Vin1、2に接続することによって、近似的に端子Vrefの電圧に端子Vin1、2の電圧を加えた電圧をボルテージ・ホロワ回路1204から出力することが出来る。

【0085】ここで、コンデンサ1202、1203の静電容量を同じにすると結果的に端子Vin1、2の電圧を均等に重み付けされた補正電圧となり、言い替えれば平均化されたものとなる。またこの2つのコンデンサの静電容量を異なった値、例えばコンデンサ1202より1203の静電容量を大きくすることによって、電圧検出電極YD2の電圧変化の補正電圧に対する寄与を大きくすることが出来る。

【0086】これらのコンデンサ1202、1203の静電容量は実験等で容易に設定することが出来る。ま

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た、コンデンサ1202、1203の静電容量を同じに設定しておき図11の電圧検出電極YD1よりYD2を例えば幅広くすることによって、同じよう補正電圧に対する寄与を大きくすることが出来る。

【0087】従って、実施例3と同様の動作をし、さらに電圧検出電極を複数本化することによって、走査電極上の駆動波形に発生する歪をより正確に検出することが出来るので、より表示むらを解消することが出来る。

【0088】なお、実施例3に対する実施例5と同様に、複数の電圧検出基板を信号電極が形成されている基板上に走査電極Y1～Y6の全てに対向するように左右の両辺部に設けて、電源部を同様の回路構成にすることによって、横糸引きについても本実施例と同様の効果が得られる。

【0089】[実施例8] 実施例7では液晶パネルの走査電極が形成されている基板上に電圧検出電極を複数本形成し、これらの電圧検出電極に発生する電圧を複数の変数とした関数の電圧を1つの補正電圧として用いたが、例えば液晶パネルの左側の信号電極の駆動電圧波形の変化の総和と右側の信号電極の駆動電圧波形の変化の総和とが全く異なる場合にはこれらの信号電極に異なった補正電圧を加えた方がより表示むらを解消することが出来る。従って、複数の電圧検出電極から得られる電圧変化から複数の補正電圧を発生させて、これらの補正電圧について、ある補正電圧を発生させる電圧検出電極が交差する信号電極あるいは走査電極毎の駆動電圧波形にその補正電圧を個別に付け加えることによって、さらに表示むらを改善出来る。これを図13を用いてさらに詳しく説明する。図13に本実施例の一構成例を示す。

【0090】図でYドライバ12は図1のYドライバと同じ構成と動作をするので説明を省略する。

【0091】図13で10dは液晶パネルで、図1の液晶パネル10の基板101上に新たに電圧検出電極YD1、2が図に示すようにお互いに突き合わされて信号電極X1～X6の一部に各々対向するように上辺部に設けてある。ここで、電圧検出電極YD1、2の突き合わせ部分は本実施例では楔状となってある信号電極（本実施例では信号電極X2～X5）と共有して交差している。しかし、必ずしも突き合わせ部が同じ信号電極と共有して交差する必要は無い。さらに2つの電圧検出電極YD1、2は分離してなくとも良い。即ち、短絡させてあっても良い。

【0092】11L、11M、11RはXドライバで、図1のXドライバ11と内部の各回路の構成ビット数が異なっている以外は同じ構成と動作をする。そして、これらのXドライバ11L、11M、11Rにはそれぞれ異なった電圧構成の電圧が供給されて、この電圧によって各々駆動電圧波形を出力する。

【0093】133は電源回路で、1331～1333以外の構成と動作は図11の電源回路1130と同じな

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ので説明を省略する。

【0094】1331、1333は加算器群で図2で示される加算器からなり電圧V0、V2、V3、V5に対応して設けられている。

【0095】1332は加算器群で、この加算器は図12で示される加算器からなり電圧V0、V2、V3、V5に対応して設けられている。

【0096】加算器群1331、1332、1333の出力する電圧はそれぞれXドライバ11L、11M、11Rに供給される。

【0097】以上の構成となっているので、電圧検出電極YD1には信号電極X1～5までの駆動電圧波形の電圧変化の総和が発生する。ここで、電圧検出電極YD1の先端部は楔状となっているので、信号電極X1からX5へ向かう程、駆動電圧波形の電圧変化の重み付けが小さくなっている。同様に電圧検出電極YD2にも信号電極X1～5までの駆動電圧波形の電圧変化の総和が発生するが、信号電極X5からX1へ向かう程、駆動電圧波形の電圧変化の重み付けが小さくなっている。

【0098】従って、ボルテージ・ホロワ回路6321は主に液晶パネル10dの左側の信号電極の駆動電圧波形の電圧変化の総和を出力し、ボルテージ・ホロワ回路6322は主に右側の信号電極の駆動電圧波形の電圧変化の総和を出力する。

【0099】ここで、ボルテージ・ホロワ回路6321の出力電圧は補正電圧として加算器群1331に供給され、加算器群1331の出力はXドライバ11Lに供給される。同様にボルテージ・ホロワ回路6322の出力電圧は補正電圧として加算器群1333に供給され、加算器群1333の出力はXドライバ11Rに供給される。そして、ボルテージ・ホロワ回路6321、6322の出力を2つの補正電圧として加算器群1332に供給し、加算器群1332はこの2つの補正電圧を平均化した補正電圧を付け加えた電圧をXドライバ11Mに出力する。

【0100】以上の動作をするので、液晶パネル10dの左側の信号電極の駆動電圧波形にはこの左側の信号電極の駆動電圧波形の変化に多く重み付けされた駆動電圧波形の変化の総和による補正電圧が付け加わり、左側の信号電極の駆動電圧波形には右側の信号電極の駆動電圧波形の変化に多く重み付けされた補正電圧が加わり、中央部では左右の平均化した補正電圧が加わることになる。

【0101】従って、各信号電極の駆動電圧波形には略最適な補正電圧が個々に付け加わってより一層表示むらを解消することが出来た。

【0102】なお、本実施例では加算器群1331、1333を図2で示される加算器としたが、図12で示される加算器とし、加算器群1332と同様にボルテージ・ホロワ回路6321、6322の2つの出力を入力し

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て、この2つの入力電圧の寄与分を図12のコンデンサ1202と1203の静電容量で適宜設定して、出力しても良い。

【0103】また、本実施例では異なった補正電圧の数を3としたがこれは液晶パネルの大きさ等で適宜増減しても構わない。

【0104】さらに、本実施例では電圧検出電極を用いた方法を示したが、例えば図13のXドライバ11L、M、Rの各々について、これらのXドライバに供給される点灯電圧、非点灯電圧の電流をそれぞれ微小な値の抵抗器等で各々検出しそれを足し合わせるることによっても本実施例と同じような複数の補正電圧を得ることが出来、これを用いて同様の補正を行うことによって、本実施例と同様の効果が得られる。

【0105】以上、述べたように付け加える補正電圧を信号電極の液晶パネルの位置するところによって異なった補正電圧とすることで、より一層表示むらを解消することが出来た。

【0106】〔実施例9〕実施例8では液晶パネルの走査電極が形成されている基板上に電圧検出電極を複数本形成し、これらの電圧検出電極に発生する電圧を複数の変数とした関数の電圧を3つの補正電圧として用いたが、例えば電圧検出電極を1本形成し、この電圧検出電極に発生する電圧をから3つの補正電圧を発生させ、個別の信号電極の駆動電圧波形にある1つの補正電圧を付け加えても良い。例えば、筆者等の実験で液晶パネルの走査電極の駆動電圧波形を印加する端子が左側にある場合には、1本の電圧検出電極から得られた電圧を小さく増幅した補正電圧を液晶パネルの左側に位置する信号電極に、大きく増幅した補正電圧を液晶パネルの右側に位置する信号電極に、付け加えることによって表示むらがより解消することが実験的に解った。これを図14に示す。図14は本実施例の一構成例を示す。

【0107】図で10aは液晶パネル、12はYドライバで図6と同じ構成となっており、また11L、M、RはXドライバで図13と同じ構成となっている。

【0108】さらに143は電源回路で1431～1433以外は図6の電源回路63と同じ構成となっている。そこで、これらの説明は省略する。

【0109】図14で1431～1433は加算器群でそれぞれ図2に示す加算器で構成されている。但し、図2のコンデンサ202の容量は加算器群1431では小さく、1433では大きく、1432ではその間の値をとるようになっている。

【0110】即ち、端子Vinに加わる電圧が同じでも、付け加えられる補正電圧が加算器群1431が一番小さく、次に1432、そして1433が最も大きくなるように設定されている。

【0111】以上の構成となっているので、電圧検出電極から得られた電圧から複数の補正電圧を発生させるこ

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とが出来、走査電極の駆動端子から遠い信号電極程大きな補正電圧が駆動電圧波形に付け加えることができるので、より一層表示むらを解消することが出来た。

【0112】〔実施例10〕実施例3等では電圧検出電極の形状について、特に詳しく触れなかったが液晶パネルの形状によっては、電圧検出電極の形状を変えることによってより一層表示むらを解消することが出来る。これを図15を用いて説明する。図15は液晶パネルの構成を示す図である。本図は図14の液晶パネル10aと各電極の形状が異なる以外は同じである。ここで、走査電極Y1～Y6の形状は液晶パネル10aと同じ形状をしており、信号X1～X6は上下交互に駆動電圧が供給される端子が形成されている。(図15ではX1、3、5と奇数番号の信号電極が上にこの端子が形成されている。)ここで、電圧検出電極YDは上辺部分に各信号電極と交差するように形成されている。そして、電圧検出電極YDは奇数番号の信号電極と交差する部分では幅が狭く、偶数番号の信号電極と交差する部分では幅が広くなるように形成されている。

【0113】以上のような形状に電圧検出電極YDを形成してある。

【0114】これによって、駆動電圧が印加する端子が近い信号電極と電圧検出電極YDの容量結合は小さくなり、駆動電圧が印加する端子が遠い信号電極と電圧検出電極YDの容量結合は大きくなる。よって、電圧検出電極YDの位置で、減衰の少ない奇数番号の信号電極上の駆動電圧波形の変化によって小さな重み付けで電圧検出電極YDに微分電圧を発生させ、減衰の大きな偶数番号の信号電極上の駆動電圧波形の変化は大きな重み付けで電圧検出電極YDに微分電圧を発生させる。

【0115】よって、電圧検出電極YDに対して、駆動電圧波形を印加する端子が遠い信号電極と近い信号電極の電圧変化を均等に電圧検出電極YDが取り込むことが出来る。これによって、より正確に走査電極上に発生する歪を推測出来、ひいてはより正確な補正電圧を発生することが出来るのでより一層表示むらを解消出来る。

【0116】〔実施例11〕実施例3等では電圧検出電極が検出した電圧を一定の倍率で増幅した電圧を補正電圧としていた。ここで、電圧検出電極と対向する信号電極との電圧差は概ね0Vである。しかし、実際の走査電極と対向する信号電極との電圧差は実効電圧で数V程度である。液晶は一般に印加する実効電圧が大きくなるとその誘電率が大きくなる。このことは液晶パネルの表示ドットが多く点灯することによって、液晶パネルが作るコンデンサの静電容量が大きくなることを意味する。従って、信号電極の駆動波形の電圧変化の総和が同じでも、より多くの歪を各走査電極上の駆動電圧波形に発生させる。しかし、電圧検出電極と対向する信号電極との容量結合の度合いは表示の如何によらず一定なので、表示の点灯ドット数の多少によって、補正電圧が不足する

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ことになる。よって、表示の点灯ドット数の多少によって補正電圧の量を増減することにより、点灯ドット数の如何によらず表示むらのない表示が行える。これを、図16で説明する。図16は本実施例の一構成例を示す。図で電源回路163と点灯ドット数計数回路164以外の構成は図6の構成と同じであり説明を省略する。図16の164は点灯ドット数計数回路で計数回路1641とラッチ回路1642からなる。計数回路1641はCK信号に同期してデータ信号が“1”の時カウント・アップしDI信号に同期して計数値をラッチ回路1642に取り込ませると同時に計数値を0にして再び計数を開始する。ラッチ回路1642の出力は電源回路163の可変増幅器1631に取り込まれる。

【0117】163は電源回路で1631以外の構成は図6の構成と同じであり説明を省略する。1631は可変増幅器で点灯ドット数計数回路164の数値が大きくなると増幅率が大きくなる増幅回路である。この回路の一構成例を図17に示す。

【0118】図で171は演算増幅器、172～175は抵抗器で173は174の半分の抵抗値、174は175の半分の抵抗値を持つ。176～178はスイッチ回路で各々抵抗器172～175に並列に接続されている。これらの抵抗とスイッチ回路は本実施例では3個となっているがこの数は適宜増減しても構わない。Vref、Vin端子にはそれぞれ図16のスイッチ回路603の出力、ボルテージ・ホロワ回路632の出力が接続してある。従って、抵抗172の抵抗値と抵抗器173と175の間の抵抗値の比によった増幅率を持つ非反転増幅回路が形成されてVref端子の電圧を基準にVin端子に入力された電圧がこの増幅率で増幅されて出力される。ここで、スイッチ回路176～178は点灯ドット数計数回路164が出力する複数ビットのバイナリの数値でオン／オフ制御される。即ち、バイナリ数値が“1”の場合にオフ、“0”の場合にオンになる。また、上位の数値がスイッチ回路178の制御を行い、下位の数値がスイッチ回路176の制御を行う。これにより、数値が大きくなると抵抗器173と175の間の抵抗はこれに比例して大きくなる。従って、点灯ドット数が多くなると増幅率が大きくなる。

【0119】以上の構成となっているので、液晶パネル10aの表示ドットが多く点灯すると補正電圧も大きくなって、点灯ドット数の如何によらず表示むらのない表示が行える。

【0120】〔実施例12〕実施例4では電源回路73中の非選択電圧(V1、V4)に流れる電流を検出することによって、Xドライバ11に供給する電圧に補正電圧を付け加えたが、Yドライバ12に供給する電圧に補正電圧を付け加えても良い。これを図18を用いて説明する。図18は本実施例の具体的な一構成例を示す。図で電源回路183以外は図1の構成と同じであり、説明

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を省略する。さらに電源回路183中の141、OP2、OP3はそれぞれ図1の同番号と同じものである。1810、1840は、それぞれ電圧V1、V4に補正電圧を付け加える電圧補正回路であり、電圧分割回路131とYドライバ12の間に設けられてある。電圧補正回路1810、1840は同じ回路構成となっており、図19に電圧補正回路1810、1840の具体的な一構成例を示す。ここで、以下、実施例12～16に於いて、FR信号に応じて非選択電圧が電圧V1が使用される期間について説明を行うが、電圧V4が使用される期間についても同様である。図19で、Vin端子は電圧V1（あるいはV4）を入力する端子である。1911は電流検出用の抵抗器であり、非選択電圧が印加される走査電極に流れる電流の総和に比例した電圧がその両端に発生する。この電圧は演算増幅器1913、抵抗器1914、1915によって構成される反転増幅回路1912に印加する。反転増幅回路1912の増幅率を抵抗器1914、1915の抵抗値により適当な値に設定することによって、反転増幅器1912の出力する電圧（これをVdとする）を過渡電流の影響で歪んだ非選択電圧が印加された走査電極上の電圧とほぼ等しくすることが出来る。演算増幅器1916は演算増幅器1916の反転入力に印加された電圧V1'と非反転入力に印加されたVin端子からの電圧を等電圧とする電圧（これをVcとする）をYドライバ12に出力する。

【0121】以上の構成と動作をするので、過渡電流が流れる場合にも非選択電圧が印加した走査電極上の電圧と電圧V1（あるいは電圧V4）は常に同じ電圧に保たれる。

【0122】以上、述べたように電源回路中の非選択電圧（電圧V1とV4）に流れる電流を検出し、Yドライバ12に供給する非選択電圧に補正電圧を付け加えることによって、非選択電圧が印加した走査電極上の電圧の変動を抑えることが出来、実施例1と同様、容易で簡素に表示むらを解消することが出来た。

【0123】【実施例13】実施例12の電圧補正回路1810、1840の回路構成は図19で示した構成である必要は無く、他の回路構成でも構わない。ここで、図20に電圧補正回路の他の回路構成の一例を示す。図20の1911～1916についてはそれぞれ図19の同番号に対応している。2017はコンデンサで、抵抗器1914との組み合わせで反転増幅回路1912の時定数 τ_1 を設定する。同様に、2018、2019はそれぞれ抵抗器、コンデンサで演算増幅回路1916の時定数 τ_2 を設定する。

【0124】以上の構成となっており、これら、時定数 τ_1 、 τ_2 と実施例12で前述した増幅率の値を適当な値に設定することによって、電圧V1（あるいはV4）に過渡電流が流れた時にも、非選択電圧が印加した走査電極上の電圧の1LP信号周期当たりの実効電圧値を電

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圧V1と等しくすることが出来、実施例12と同様の効果がある。さらに、増幅回路1913、1916の出力電圧の単位時間当たりの電圧変化量は小さくなるので、スルー・レートの低い安価な演算増幅器を用いることが出来、また回路の安定性も向上させることが出来た。なお、本実施例では電源回路内を流れる非選択電圧の電流を検出する場合について述べたが、選択電圧の電流を検出する場合、さらに電圧検出電極を用いて補正電圧を発生させる場合にも同様の回路構成をとることによって、同様の効果が得られる。

【0125】【実施例14】実施例12、13等では電源回路中に流れる電流を微小な抵抗を持つ抵抗器で検出したが、電流検出に必ずしも抵抗器を使用する必要は無く、他の素子を用いても良い。ここで、図19の電圧補正回路1910、1940の電圧補正回路の代わりとして、図21に他の素子としてトランスを用いた場合の電圧補正回路の具体的な一構成例を示す。図21の演算増幅回路1916は図19の同番号のものと同じである。2120はトランスで、1次巻線2121と2次巻線2122からなる。ここで、1次巻線2121と2次巻線2122の巻数の比を適当な値にすることによって、実施例12と同様の効果が得られた。さらには構成要素数を少なく出来た。

【0126】ここで、本実施例にさらに抵抗器とコンデンサを付け加えた他の電圧補正回路の構成例を図22に示す。図22で2223、2224の抵抗器、コンデンサが図21の電圧補正回路に付け加わっている。この付け加わった抵抗器、コンデンサによって、演算増幅回路1916の時定数 τ_2 が設定され、実施例13と同じ効果が得られた。

【0127】【実施例15】実施例12～14等ではいわばぼりアル・タイムにYドライバ12に供給する非選択電圧を変化させたが、例えば前述の実施例12に於いて、電圧補正回路1810、1840を図23に示す電圧補正回路にすることによって、実施例12と同じ効果が得られると共に電圧補正回路の動作を安定にすることが出来る。即ち、図23に示すように反転増幅回路1912と演算増幅回路1916との間にスイッチト・キャパシタ回路やCCD等の遅延素子2325を挿入することによって、補正電圧を同LP信号周期内で一定時間遅らせて非選択電圧に付け加え、これをYドライバ12に供給しても実施例12と同じ効果が得られるとともに、非リアル・タイムのフィード・バックがあるために、補正電圧回路が発振しずらくなって、安定した動作が得られる。この遅延素子を挿入することは例えば、実施例13、14でも適用することが出来、同様の効果が得られる。

【0128】【実施例16】1LP周期ごとに、LP1周期開始時、あるいは開始後所定の時間が経過した時に現れる電源回路中の非選択電圧に流れる瞬間電流値、あ

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るいはピーク電流値を検出し、検出された電流値に応じた補正電圧を同LP周期の期間の一定な補正電圧として、非選択電圧(V1あるいはV4)に付け加えても良い。これを、図24で説明する。図24は図18の電圧補正回路の構成を示す図である。1911~1915は図19の同番号と同じものである。図24で、2426はサンプル&ホールド回路で、LP信号あるいはLP信号を所定の時間だけ遅らせた信号によって、過渡電流に対応して反転増幅回路1913より出力する電圧Vdを演算増幅回路1916の出力電圧Vcを基準として、サンプルし、ホールドする回路である。即ち $dV = Vd - Vc$ なる電圧をホールドする。

【0129】従って、演算増幅回路1916の非反転入力には $Vc + dV$ が印加するので、 $V1(V4) - dV$ なる一定の電圧が同LP期間出力される。

【0130】以上の動作をし、ホールドされた電圧Vdは、非選択電圧が印加した走査電極上の電圧の1LP周期当たりの実効電圧-V1(V4)に比例するから、反転増幅回路1912の増幅率を適当な値に設定することによって、過渡電流が発生する時にも、非選択電圧が印加した走査電極上の電圧の1LP周期当たりの実効電圧を電圧V1(V4)に等しくすることが可能になり、実施例12と同様の効果が得られた。

【0131】なお、本実施例では電源回路内を流れる非選択電圧の電流を検出する場合について述べたが、選択電圧の電流を検出する場合、さらに電圧検出電極を用いて補正電圧を発生させる場合にも同様の回路構成をとることによって、同様の効果が得られる。

【0132】[実施例17] 前述の実施例16ではYドライバ12に供給する非選択電圧に付け加える補正電圧を変化させることにより、非選択電圧が印加された走査電極上の電圧あるいは電圧実効値の補正を行ったが、詳細については述べないが、例えば、実施例16と同様に電源回路の非選択電圧の電流を検出して、この検出した電流値に応じた時間だけ所定の補正電圧を付け加えることによって実施例17と同様の効果が得られる。また、これは実施例16と同様に選択電圧の電流を検出する場合、さらに電圧検出電極を用いて補正電圧を発生させる場合にも同様の回路構成をとることによって、同様の効果が得られる。

【0133】[実施例18] いままで、走査電極、信号電極ともに一方の端から駆動電圧波形を印加する構造の液晶パネルについてのみ述べてきたが、走査電極、信号電極のいずれかあるいは両方について両方の端駆動電圧波形を印加する構造の液晶パネルについても上述の実施例を適応出来る。又、電圧検出電極を設けて補正電圧を発生する実施例においては、電圧検出電極の電圧を取り出す端子も一方の端だけではなく両端から検出するような回路構成、あるいは走査電極、信号電極の駆動電圧端子のある側と反対側に電圧検出電極の端子を形成しても

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良い。さらに電圧検出電極は上下左右どの辺の近くに形成しても良く、表示に差し支えなければ例えば中央部分に形成してもよい。

【0134】さらに実施例1から17の内の幾つかを複合して用いることも容易で、例えば実施例3と実施例5を複合することによって縦糸引きと横糸引きの両方の表示むらを解消することが出来る。

【0135】さらにまた、本実施例1~17では1対の基板上に1組の複数の信号電極及び複数の走査電極がお互い交差して表示ドットを作る液晶パネルの場合について説明したが、1対の基板上に2組の複数の信号電極及び2組の複数の走査電極がお互い、各組毎に交差して表示ドットを作る液晶パネル、いわゆる2画面駆動の液晶パネルについても、それぞれの画面に応じた補正電圧をそれぞれの画面を駆動するXないしYドライバの電源電圧に付け加えることによって、同様の効果が得られる。そして、この時、一方の画面を駆動するXないしYドライバに供給するFR信号を反転した信号を他方の画面を駆動するXないしYドライバに供給するFR信号として、供給することによって回路構成を一部共有化出来、回路構成を簡素化出来る。即ち、一方の画面が選択、非選択、点灯、非点灯電圧としてV0(5)、V4(1)、V5(0)、V3(2)を用いる時に、他方の画面はV5(0)、V1(4)、V0(5)、V2(3)を用いるので、例えば、非選択電圧に補正電圧を付け加える方法の場合に、一方の画面がV1を用いる時に、V1に一方の画面の表示に応じた補正電圧を付け加え、この画面を駆動するYドライバに供給すると同時に、V4に他方の画面の表示に応じた補正電圧を付け加え、この画面を駆動するYドライバに供給することが出来る。従って、補正電圧回路を共有することが出来る。

【0136】[実施例19] なお、本明細書では説明を簡単にする為に主に電圧平均化駆動方法を例に説明してきたが、走査電極に選択電圧が印加する期間中に信号電極に印加する電圧が変化する駆動方法(例えば、点灯電圧と非点灯電圧が印加する時間が増減する、いわゆるパルス幅変調による階調表示方法)、複数の走査電極に同時に選択電圧を印加する駆動方法、走査電極あるいは信号電極に多くの電圧レベルからなる駆動電圧波形を供給して駆動する方法等についても上述の実施例は表示むらを解消する効果がある。

【0137】[実施例20] 表示機能を必要とする電子機器例えばパーソナルコンピュータ、ワードプロセッサ、電子手帳等を実施例1から19のいずれか表示装置を用いることによって電子機器の表示品質を向上させることが出来る。

【0138】

【発明の効果】以上述べたように、液晶表示装置系のある部分の電圧変化あるいは電流変化を検出することによって、液晶パネルの電極上に発生する歪を想定し、これ

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によって補正電圧を発生させて、この補正電圧を駆動電圧波形に付け加えることによって容易に表示むらを改善出来た。即ち、表示データから歪量を計算する回路が不要となって、極めて簡素な回路構成で高品位の表示をする液晶表示装置を提供することが出来、さらにこの表示装置を用いた電子機器の表示部が高品位となり、また小型軽量化を図ることができた。そして、液晶表示装置系のある部分の電圧変化あるいは電流変化を検出することによって、液晶パネルの電極上に発生する歪を想定し、これによって補正電圧を発生させるので、液晶パネルを駆動する駆動方法を問わずに表示むらを改善することが出来るようになった。

【図面の簡単な説明】

【図1】実施例1の液晶表示装置の構成を示す図。

【図2】実施例1の電圧加算回路の具体的な一構成例を示す図。

【図3】実施例1の液晶表示装置を駆動する信号の電圧波形を示す図。

【図4】実施例1の動作を説明する電圧波形を示す図。

【図5】実施例2の液晶表示装置の具体的な一構成例を示す図。

【図6】実施例3の液晶表示装置の具体的な一構成例を示す図。

【図7】実施例4の液晶表示装置の具体的な一構成例を示す図。

【図8】実施例5の液晶表示装置の具体的な一構成例を示す図。

【図9】実施例5の動作を説明する電圧波形を示す図。

【図10】実施例6の液晶表示装置の具体的な一構成例を示す図。

【図11】実施例7の液晶表示装置の具体的な一構成例を示す図。

【図12】実施例7の電圧加算回路の具体的な一構成例を示す図。

【図13】実施例8の液晶表示装置の具体的な一構成例を示す図。

【図14】実施例9の液晶表示装置の具体的な一構成例を示す図。

【図15】実施例10の液晶パネルの具体的な一構成例を示す図。

【図16】実施例11の液晶表示装置の具体的な一構成例を示す図。

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【図17】実施例11の可変増幅器の具体的な一構成例を示す図。

【図18】実施例12の液晶表示装置の具体的な一構成例を示す図。

【図19】実施例12の電圧補正回路の具体的な一構成例を示す図。

【図20】実施例13の電圧補正回路の具体的な一構成例を示す図。

【図21】実施例14の電圧補正回路の具体的な一構成例を示す図。

【図22】実施例14の他の電圧補正回路の具体的な一構成例を示す図。

【図23】実施例15の電圧補正回路の具体的な一構成例を示す図。

【図24】実施例16の電圧補正回路の具体的な一構成例を示す図。

【符号の説明】

10は液晶パネル

101、102は一对の基板

Y1～Y6は走査電極

X1～X6は信号電極

11は信号電極駆動回路(Xドライバ)

111はシフト・レジスタ回路

112はラッチ回路

113はアナログ・スイッチ回路

12は走査電極駆動回路

121はシフト・レジスタ回路

122はアナログ・スイッチ回路

13は電源回路

131は電圧分割回路

R1～R5は抵抗器

OP1～OP4はボルテージ・ホロワ回路

132は基準電圧切り替えスイッチ

133は入力電圧切り替え制御回路

134は入力電圧切り替え制御信号

135は入力電圧切り替えスイッチ

136は差動増幅回路

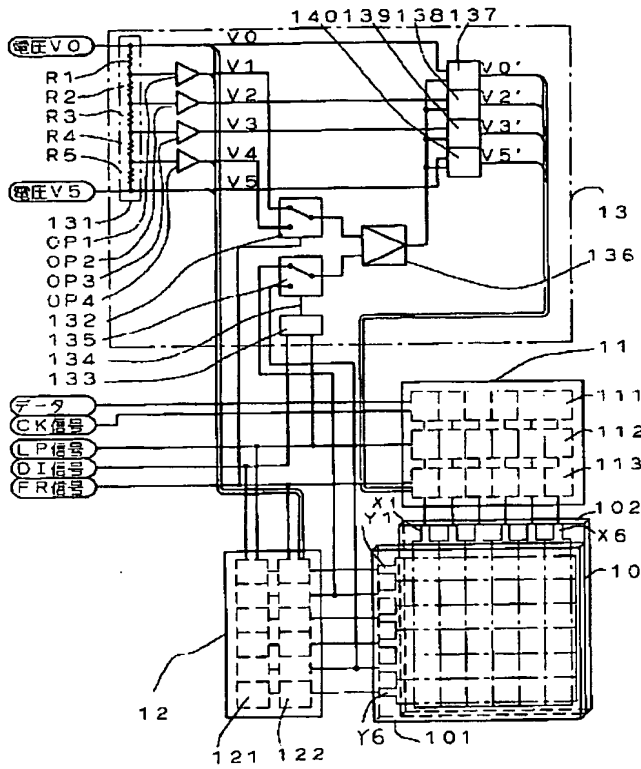
137～140は電圧加算回路

電圧V0、V5は外部から供給される電圧

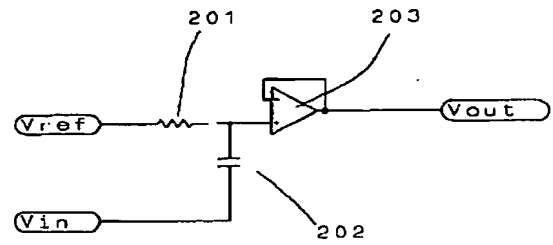
データ信号、CK信号、LP信号、DI信号、FR信号は液晶表示装置を駆動する信号

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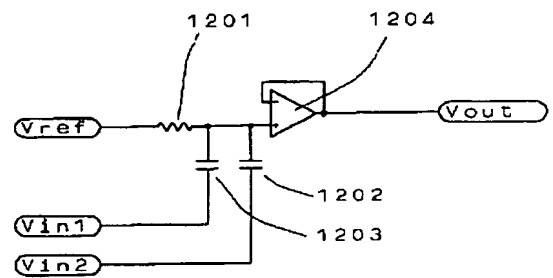
【図1】



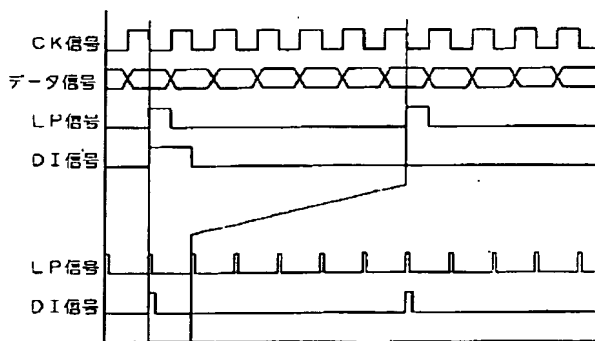
【図2】



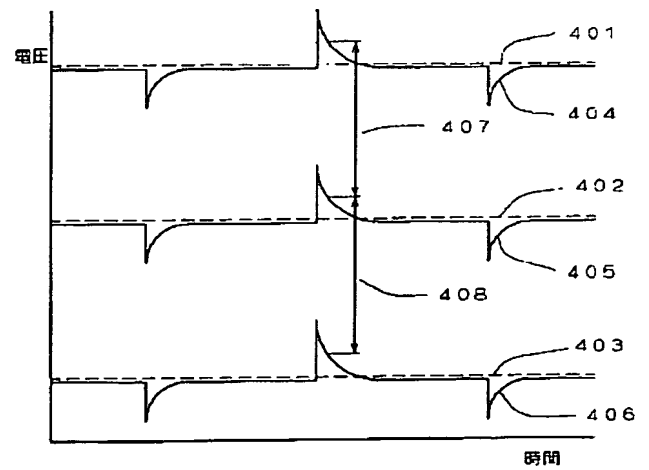
【図12】



【図3】

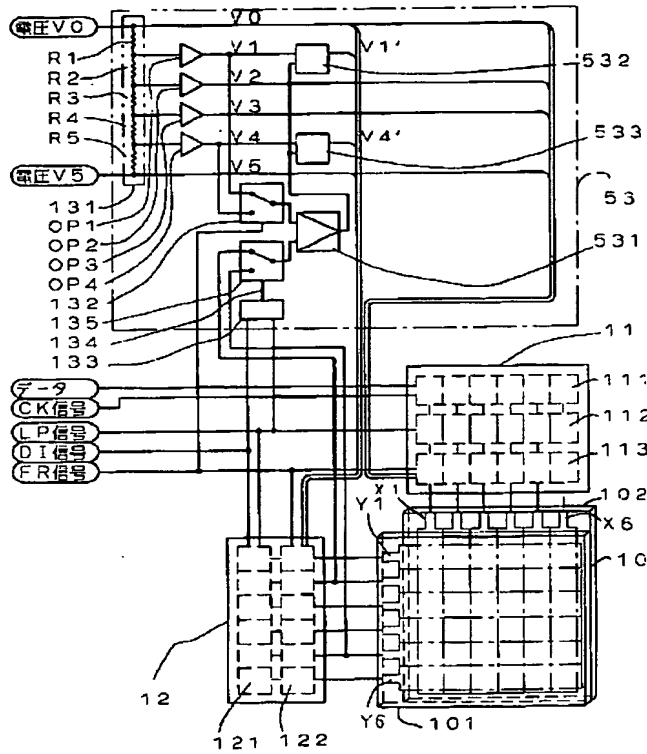


【図4】

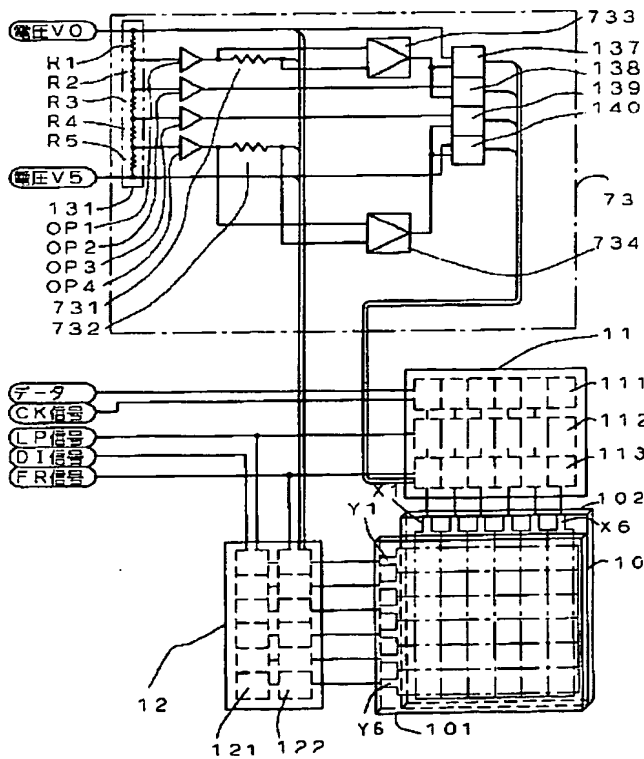


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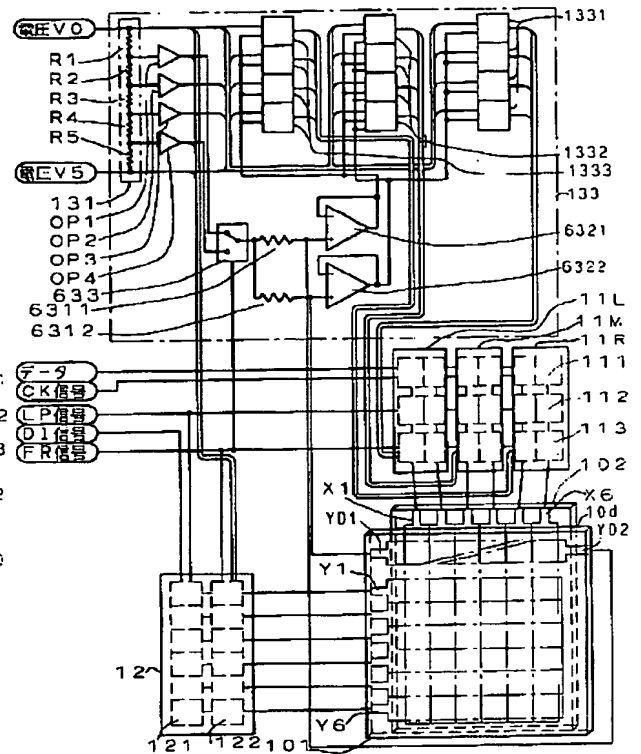
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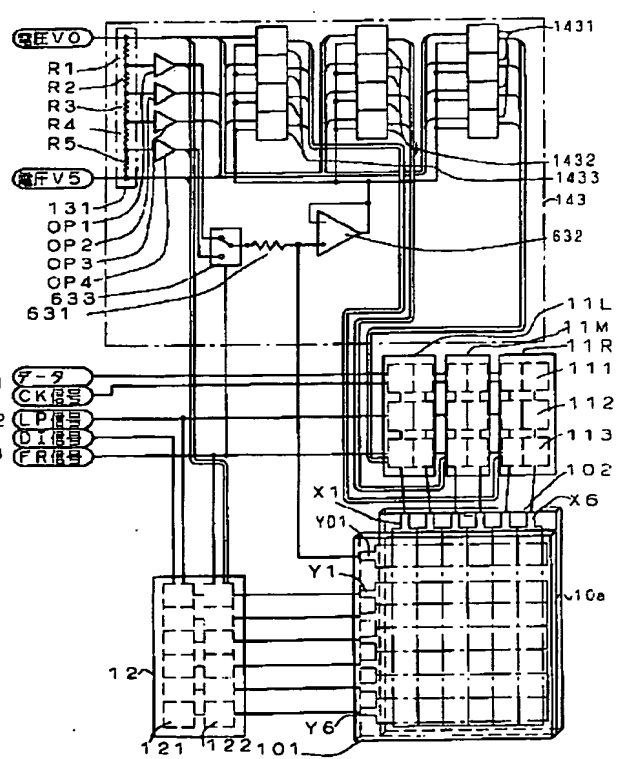
【図7】



【図13】

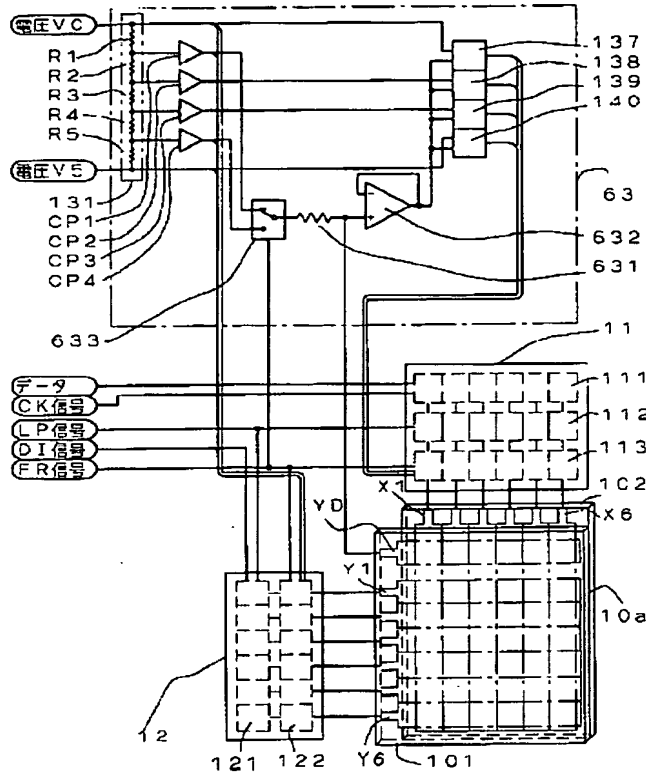


【図14】

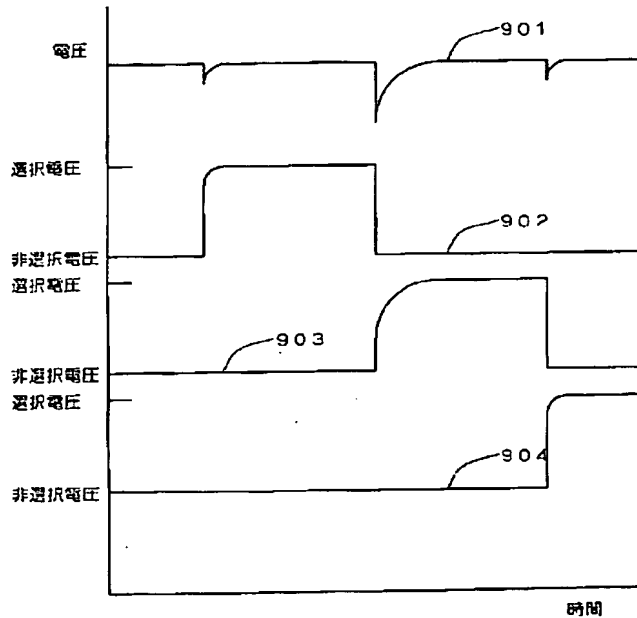


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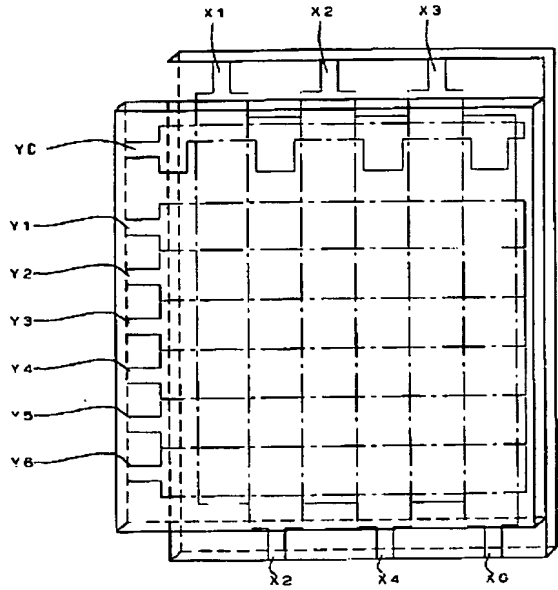
【図6】



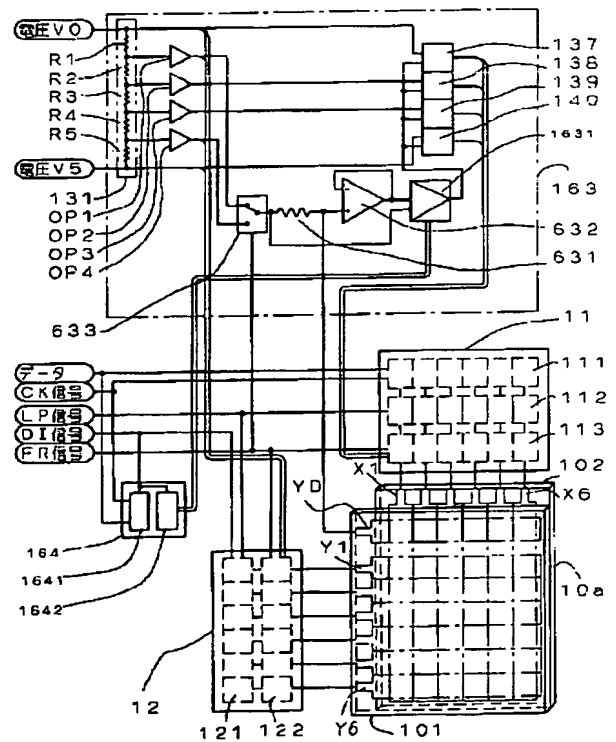
【図9】



【図15】

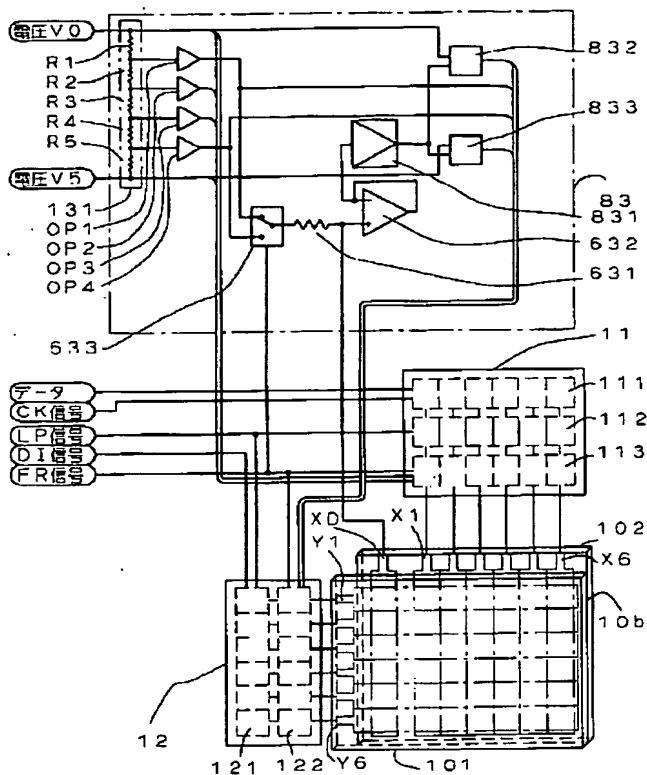


【図16】

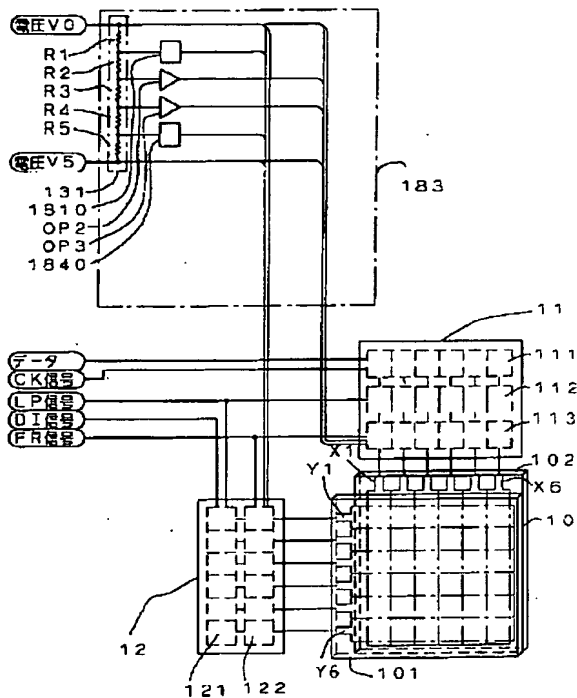


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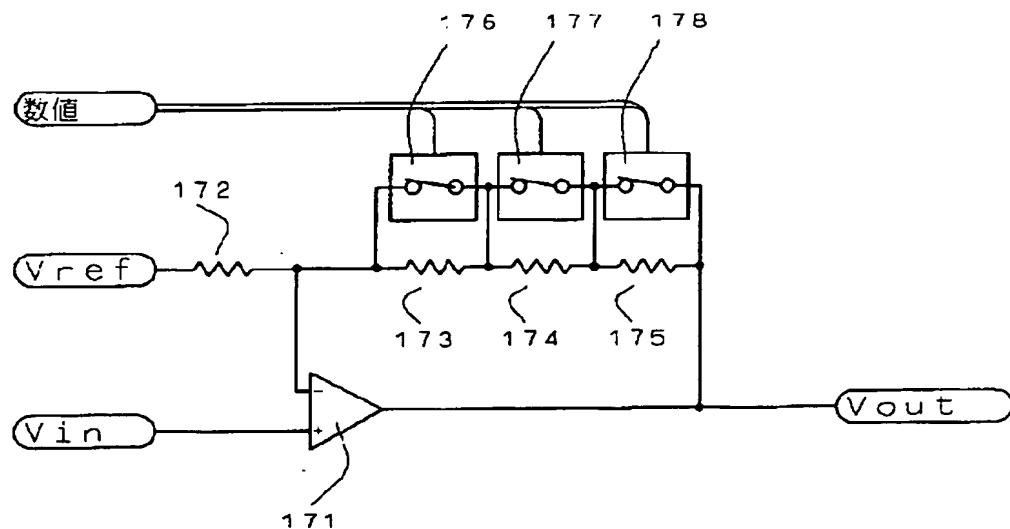
【図8】



【図18】

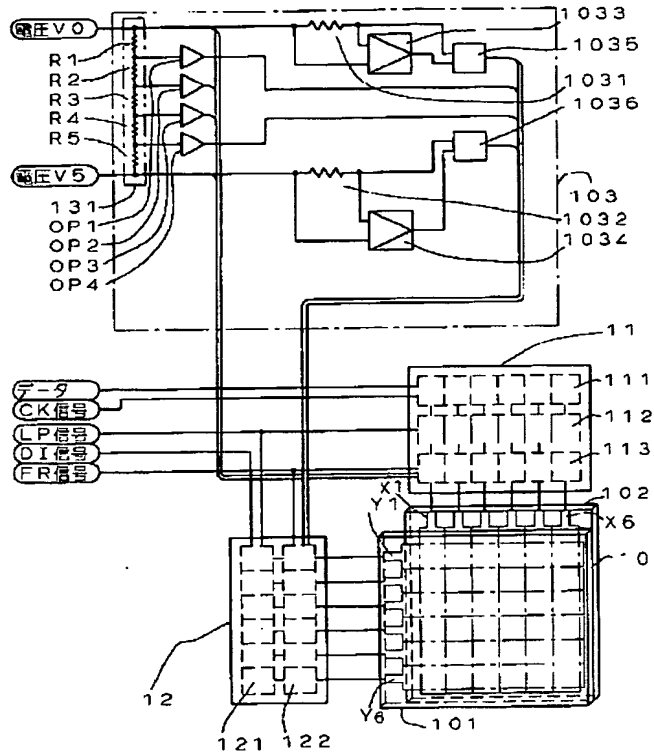


【図17】

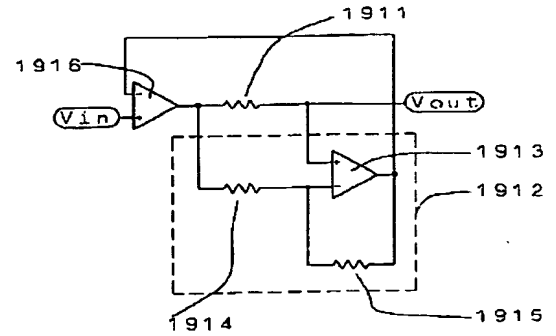


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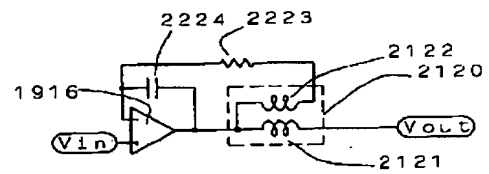
【図10】



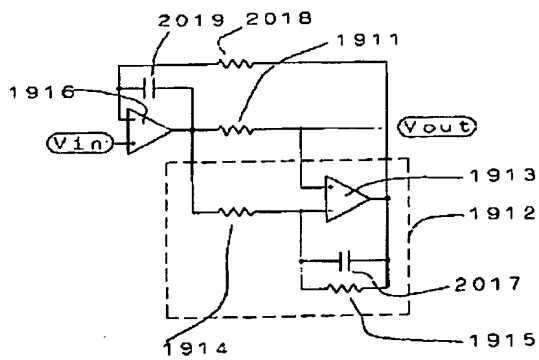
【図19】



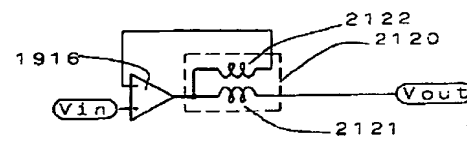
【図22】



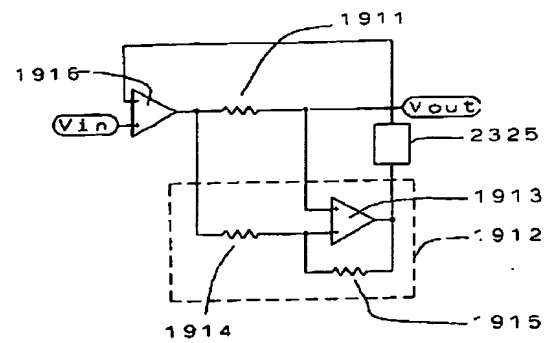
【図20】



【図21】

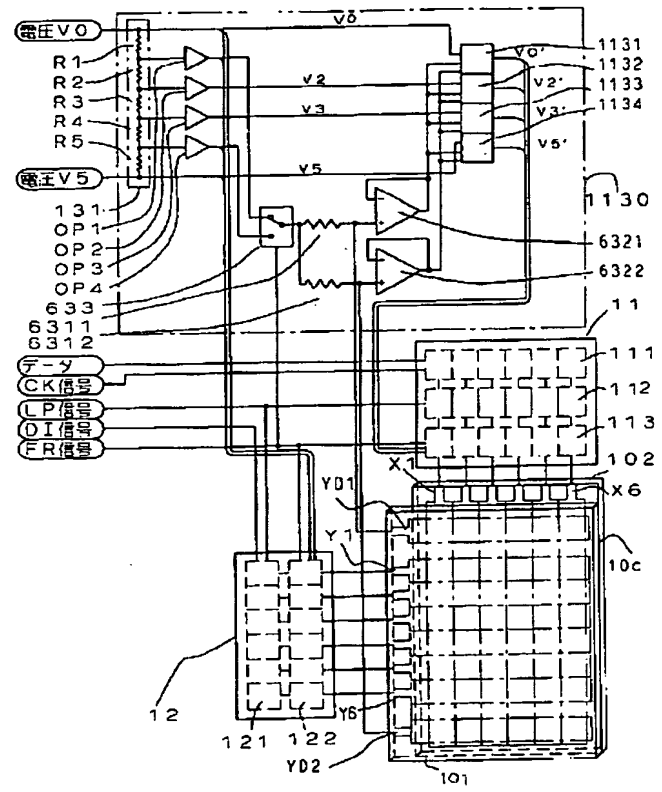


【図23】

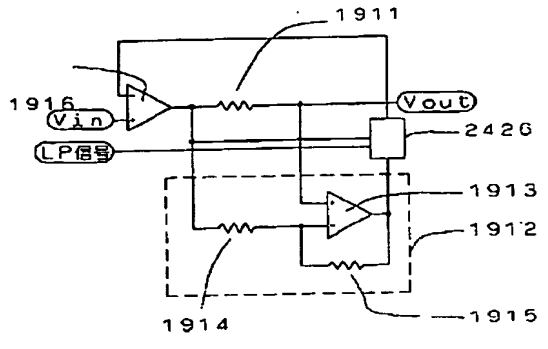


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【図11】



【図24】



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